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ANNALS OF SURGERY

A MONTHLY REVIEW OF SURGICAL SCIENCE AND PRACTICE

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No 1

ORIGINAL MEMOIRS.

A FURTHER CONTRIBUTION TO THE STUDY OF PERICOLIC MEMBRANOUS FILMS AND BANDS.

BY LEWIS STEPHEN PILCHER, M.D.,
OF BROOKLYN, N Y

IN a paper which was published in the ANNALS OF SURGERY, for January, 1912, after a study of a limited number of cases which had been observed by me personally, and a review of the literature of the subject, I formulated the conclusion that right-sided pericolic adhesions and membraniform veils and bands formed a fairly distinct pathologic entity deserving recognition as a well-defined surgical condition. As to the etiology of these films and bands, it seemed to me most probable that they were the result of long-continued or oft-repeated mild infections of the peritoneal covering of the cæcum and appendix transmitted through the intestinal wall. Since that paper was written, I have had an opportunity to observe additional cases, and it is upon the facts elicited in these cases that I wish to base some further observations. In the period of time that has elapsed since the publication of my paper, there have also been published a number of important contributions upon the subject, including papers by William J Mayo, F G Connell, Joseph R Eastman, Jabez N. Jackson, Isaacs, Coffey, Flint, and others. In my first paper, in giving credit to those who had contributed to the development of knowledge upon the subject, I was unfortunate enough to have overlooked the observations published in 1905 by Professor Binnie, of Kansas City, in which, under the name of pericolicitis dextra, the condition now

In the remaining 26 cases we believe that the primary focus or point of entrance of the organism was not found, but was nevertheless present. These cases have often been classed as primary and possibly correctly so. Allen and Lull³ reported their case in 1901 as the first primary case on record, while a year later Cole²⁰ classified 9 cases as primary. The question is largely an academic one hinging on whether the pneumococcus can traverse a mucous membrane without causing a lesion of the same, or whether this lesion if present shall be called the primary focus and be disregarded. For our part we prefer to consider all the cases as secondary, arguing that the joint can only be infected through the blood or lymphatic streams and that the organism in order to reach either of these systems must traverse the epithelial covering of the body, either skin or mucous membrane, and in so doing cause a lesion, no matter how small, which actually is the primary focus.

PATHOGENESIS

In the meta- or postpneumonic cases the portal of entry is unquestionably the respiratory tract. In the prepneumonic cases and in those not associated with a pneumonia the point of entry is varied. In many cases it cannot or is not found, 29 of our 47 cases. Probably in the majority of these cases, as pointed out by Herzog,⁵⁷ the portal of entry is the middle ear. Especially is this true in children. Zeufel (quoted by Howard) found 40 per cent of the cases of otitis media in children to be due to the pneumococcus. Reference to page 78 shows the portals of entry which we have encountered. Three reports are particularly worthy of mention. In Nattan-Larrier's⁹⁴ case a pneumococcus arthritis of the shoulder followed the infection of an operative harelip wound, the organism being recovered from the pus in the joint and from the wound. In Low's⁸⁰ case a multiple arthritis from which the pneumococcus was recovered was secondary to a primary hemorrhagic ulcerative pneumococcus cystitis. In Cohen's²⁵ case the arthritis

followed a double pyosalpinx with operation followed by umbilical fistula, but unfortunately the bacteriology of the pelvic process was not known. The general statement can be made that the portal of entry is usually one of the mucous membranes associated with the structures connected with the mouth, nose, or pharynx. Hirschberg⁵⁹ has recently reported a series of 43 cases of malignant pneumococcus tonsillitis in which 7 per cent of the cases developed an arthritis.

That the path of infection from the point of entrance to the joint is usually the blood stream is readily understood when we consider the findings of Rosenow,¹¹⁵ already quoted. We unfortunately did not analyze our cases in regard to lymphatic extension and so can only quote Pfisterer,¹⁰⁴ who found that in 7 cases of unilateral pneumonia, the shoulder-joint in all and the sternoclavicular joint in 3 cases were affected on the same side. Netter⁹⁵ also believes that lymphatic transmission of the infection occurs. We believe with Howard, however, that the blood stream is the usual path of infection.

PATHOLOGY

One or more joints may be involved, but the majority of cases are monarticular. Of our cases subject to analysis 75 per cent were monarticular and 25 per cent polyarticular. The right side (57 per cent) was involved more frequently than the left (43 per cent). The lower extremity was implicated far more frequently than the upper, the knee in the lower and the shoulder in the upper extremity being the two joints most often affected. The accompanying table represents in brief form the frequency of involvement of the various joints.

Temporomaxillary		1
Upper extremity		
Sternoclavicular		12
Shoulder		41
Elbow		18
Wrist		22
Metacarpophalangeal		3
Interphalangeal (hand)		1
		97

Lower Extremity			
Hip			23
Knee			83
Ankle			20
Metatarsophalangeal			4
Small joints of foot (one case)		I	131
Multiple (4 cases)			4
			<hr/>
			233

Of the single joints affected the knee holds first place, while practically all the monarticular cases have been either the sternoclavicular or one of the large joints. It is interesting to note that not a single case of infection of the acromioclavicular joint or of the vertebral column has been reported, and only one of the temporomaxillary joint.

The process has been suppurative 147 times, serous 15 times, suppurative and serous combined twice, and in 9 cases the data is insufficient. These figures are, however, somewhat misleading for we have encountered many cases in the literature in which the process has evidently been serous, usually in the course of a pneumonia, but in which the joints were not tapped or the fluid was not examined bacteriologically. Such cases we have of course been unable to include. Many of them are possibly examples of the so-called toxic arthritis, but we believe that the majority are cases of septic serous arthritis, pneumococcic in content, often disappearing without treatment and examples of active acquired immunity. We base this belief on the large number of such cases which have been aspirated and in which the pneumococcus has been recovered from the fluid. But even so, the majority of infectious pneumococcus joints are unquestionably suppurative in character.

The conditions found within and about the joints are essentially those of any other septic arthritis. The exudate varies from a serous to a serofibrinous or serosanguinous fluid to the more commonly found thick, creamy, greenish pus. We quote Cave.²¹ "The organism is found in the fluid exudate, either free or embedded in larger cellular elements, and a thin layer of cocci may exist on the free surface of the fibrinous layer

which covers the inflamed synovial membrane. Deeper parts of sections, whether synovial membranes, cartilage, or bone, show as a rule no micro-organisms. The synovial membrane is thickened, irregular, and sections show two layers of about the same thickness: the deeper, vascular and infiltrated with embryonal cells embedded in a meshwork of connective tissue, the superficial consisting of a network of fibrin arranged for the most part parallel to the free surface and containing leucocytes in the interstices. In mild cases or those of short duration the synovial membrane alone may be affected with loss of polish and injection of the fringes. But in many the cartilage is partially or completely eroded and the surface of the bones is laid bare. In the older or more virulent cases the changes are much more destructive, the ligament and cartilage being completely destroyed, as also in some cases the articular ends of the bones. The pus may perforate the capsule and penetrate several inches along the intermuscular planes or sheaths of the tendons. These destructive changes are well illustrated in the cases of Fernet and Lorraine³⁶ in which the joint could scarcely be recognized, and of Picque and Veillon¹⁰⁵ in which the pus burrowed upward from the knee along the femoral artery for six inches and downward between the muscles of the calf. In Slaughter's¹²⁵ case also much extra-articular damage was found. Gasne⁴⁶ believes that in many of the cases in infants not associated with a pneumonia the primary focus is often bony rather than arthritic. He says that in opening these joints we should look carefully for some small focus occurring in one of the bones entering the joint not covered with hyaline cartilage but lying inside the capsule.

SYMPTOMATOLOGY

The symptoms vary but little from those of any other septic arthritis. No one picture representing the disease in all its various phases can be drawn. Locally there is discomfort which may vary from a mere twinge of pain to pain so excruciating that the slightest touch or motion of the joint may render it well-nigh unbearable. Loss of function invariably

accompanies the pain. Swelling is variable depending on the amount of fluid and whether the capsule is or is not perforated. The joint may not be discolored, the skin over it being normal, but redness and œdema always accompany periarticular involvement. In the chronic cases the skin may be white and show large, dilated veins. Tenderness is, of course, marked, but it is diffuse over the joint, so failing to show localized osseous involvement. The presence of crepitus has not been noted.

The general picture is usually that of a severe toxæmia but many cases are recorded in which the process has been so chronic that a tuberculous or gonorrhœal joint has been suspected. At the other extreme are exceedingly virulent cases in which the picture is that of an acute, overwhelming infection rapidly terminating in death. Such a case is that reported by Pitt¹⁰⁶ in which the patient died in 48 hours after the onset of the first symptom. The majority of cases fall midway between these two extremes. The temperature is moderate not often rising above 102 to 103°, accompanied by a corresponding increase in the pulse rate. Uncomplicated cases are not excessively sick. In children the general condition seldom keeps pace with the local condition, and a child with a joint full of pneumococcus pus may be bright and eat and sleep well.

In the complicated cases the picture is usually that of severe general sepsis with high fever, rapid pulse, great prostration, chills, and sweats. Such symptoms seldom occur except in the presence of complications and are the result more of the complications than the accompanying arthritis.

COMPLICATIONS

In 45 per cent of the cases (78 times) the presence of complications other than pneumonia has been noted, but this figure is probably too low, for many of the reports are incomplete. Briefly tabulated, the complications found were as follows

Endocarditis	22
Pleurisy and empyema	19
Meningitis	16

Pericarditis	16
Septicæmia	10
Abscess	
Buttock	2
Thigh	4
Arm	2
Parotid	1
Thyroid	1 10
Otitis media	6
Acute nephritis	4
Peritonitis	3
General pyemia	2
Osteomyelitis	2
Splenic and renal infarcts	1
Septic pulmonary infarct	1
Septic thrombus of arm	1
Myositis	1
Cellulitis	1
Vaginitis	1
Cystitis	1
Conjunctivitis	1
Decubital gangrene	1

Among the cases reported within recent years many have shown a pure pneumococcus blood culture, but we have been unable to obtain definite statistics on this point

DIAGNOSIS

In most cases following pneumonia the diagnosis of pneumococcus arthritis is easy, but because of its rarity (0.14 per cent) it may be overlooked. Localized articular pain and swelling occurring during or following a pneumonia should not only be presumptive evidence of a pneumococcus arthritis, but should be an indication for immediate exploratory aspiration and bacteriological examination of the fluid by smears, cultures, and animal (mouse or rabbit) inoculation. Only by this means can an accurate diagnosis be reached.

The disease must be differentiated from a number of conditions which it may simulate and which may also be found in connection with a pneumonia. Smirnow,¹²⁶ in examining ten cases of polyarthritis complicating pneumonia, found five in

which the arthritis was due to a streptococcus, staphylococcus, or bacillus typhosus, while Gabbi and Puritz ¹² and others have reported examples of periarticular localization of the pneumococcus which have closely resembled true articular lesions. Remembering always that the ultimate differentiation must depend on bacteriological examination, there are clinical features which may at times be of service.

Acute suppurative arthritis due to the staphylococcus or one of the various strains of streptococci simulates closely a true pneumococcus arthritis in often occurring after a pneumonia and frequently being monarticular. The constitutional symptoms, however, are apt to be more severe, especially in children, in whom the condition is most apt to be found. Diagnostic aspiration is paramount.

Tuberculous arthritis will rarely cause difficulty, except in the acute fulminating cases which occur in children. Here the use of a tuberculin test will be of assistance. In older individuals the chronic course and constitutional symptoms aid in establishing a diagnosis.

Gonorrhæal arthritis is usually multiple and the original focus of infection can possibly be traced. The complement-fixation test, as first suggested by Muller and Oppenheim,¹³ may give the necessary clue to the real nature of the condition.

Syphilitic arthritis is rare, of slow onset and of chronic painless course, almost invariably showing a positive Wassermann reaction. This is especially true of the cases of hereditary syphilis occurring in children which are most apt to be confounded with pneumococcus arthritis. The characteristic teeth, facies, and other syphilitic manifestations are also usually present.

Acute rheumatic arthritis is usually multiple, excessively painful, and in children frequently accompanied by endocarditis. The tendency to the involvement of new joints together with the subsidence of those joints first affected is characteristic, while the redness and extreme tenderness are far in excess of that found in pneumococcus arthritis.

In infants under one year of age *scurvy* might be suspected, but close observation will reveal the typical gums of scorbutus and the fact that the pain and swelling are not at the joint but at the epiphysial cartilage

PROGNOSIS

The prognosis, always grave, is better when only one joint is affected and complications are absent. Thus in our series, of 66 patients with a monarthrititis and no other focus of infection only 24 per cent died, while of 98 cases with multiple foci 72 per cent died, showing conclusively that the danger lies not in the local but rather in the general infection. The prognosis is better in the younger than in the older patients. Among 69 cases below the age of 20 the mortality was 42 per cent, while among 92 cases above that age the mortality was 57 per cent. Herzog gives the mortality among infants as 39 per cent. The mortality rate of our entire series was a trifle over 50 per cent, a figure considerably below the widely quoted 65 per cent of Herrick.⁵⁶

It is quite possible for general recovery to be followed by local recovery, but statistics on this point are not available. We cannot agree with the statement frequently made that ankylosis of the joint usually results. In only 34 of our case reports is the functional result accurately stated. Of these 25 are described as resulting in good functioning joints, while in many of the reports the impression is given that the patient was left without permanent joint disability.

TREATMENT

In addition to such general measures as may be indicated, there are a number of methods of local treatment which present themselves. Palliative and temporizing methods cannot be too strongly condemned. Of 19 cases in which such means were used 17 died, a mortality of 89 per cent.¹

Radical treatment should be undertaken not only as soon as a diagnosis is made but if necessary should be utilized in arriving at such diagnosis. The four surgical means at our dis-

	18	Pernet and Lorange ¹⁸	1896	56	M	L sternoclavicular, rt shoulder	?	Suppurative		?	Shoulder recovered before death	Extreme destruction of joint
19	Griffon ¹⁹	1896	71	F	Rt ankle		?	Suppurative	Suppurative meningo- ingitis hemiplegia, acute endocarditis	Arthrotomy	D	
20	Mercantomo ²⁰	1896	71	M	Rt shoulder	Pn few days before		Suppurative		Arthrotomy	D	
21	Nicolayser ²¹	1896	3 wk	M	Rt elbow	Pn 8 days before		Suppurative	Endocarditis Bilateral empyema	O	D	
22	Schabau ²²	1896	45	M	L knee and hip	Pneumonia		Suppurative		?	D	
23	Vogelius ²³	1896	38	M	Rt sternoclavicular	Pn 5 days before		Suppurative		Arthrotomy	D	
24	Vogelius ²⁴	1896	60	M	Hip	Pn some days before		Suppurative	Lead poisoning, empyema endocarditis	Arthrotomy	D	Crystals of sodium urate in joint
25	Widal ²⁵	1896	A	M	Metatarsophalangeal	None		Suppurative	Suppurative pericarditis, lead poisoning, gout	O	D	Crystals of sodium urate in joint
26	Widal and Meslay ²⁶	1896	A	M	Metatarsophalangeal	None		Suppurative	Suppurative pericarditis	O	D	Crystals of sodium urate in joint
27	Duflocq and Ledamany ²⁷	1897	32	M	L shoulder, both elbows	Pn 9 days before		Suppurative		?	D	Crystals of sodium urate in joint
28	Heubner ²⁸	1897	5 mo		L shoulder	Pn 4 weeks before		Suppurative		Arthrotomy	R	Old rheumatoid arthritis
29	Lexter ²⁹	1897	5 mo		Knee	None		Suppurative		Arthrotomy	R	
30	Lexter ³⁰	1897	9 mo		Shoulder	None		Suppurative		Arthrotomy	R	
31	Lexter ³¹	1897	1 yr		Knee and hip	Pn 9 weeks before		Suppurative	Abscess of thigh	Arthrotomy	R	Alcoholic joint disintegrated
32	Muhsam ³²	1897	55	M	Rt shoulder	Pn 29 days before		Suppurative		Arthrotomy	R	
33	Tournier and Courmont ³³	1897	50	M	L knee and shoulder	Pn 6 days before		Suppurative	Empyema Secondary syphilis	Arthrotomy	D	
34	Widal and Mercier ³⁴	1897	46	M	Wrist and ankle	Pn 4 days before		Suppurative	Endocarditis	?	D	Typhoid arthritis 25 years before
35	Boix ³⁵	1898	A	M	Rt knee	Pneumonia		Suppurative	General pyemia	Repeated aspirations Resection	D	Chronic rheumatism and old injury of knee
36	Flament ³⁶	1898	53	M	Rt knee	Followed pneumonia		Suppurative		Arthrotomy	R	Secondary to conjunctivitis
37	Gagnon ³⁷	1898	8 mo	F	Knee	None		Suppurative	Purulent conjunctivitis	Arthrotomy	R	
38	Galliard and Morely ³⁸	1898	44	M	Rt wrist	Pn 9 days before		Suppurative	Abscess of arm, abscess of thigh	Arthrotomy	R	Secondary to abscess of thigh
39	Hagenbach and Burchhardt ³⁹	1898	2½	F	Shoulder and rt knee	None		Suppurative		Arthrotomy	R	

CHRONOLOGIC TABLE OF REPORTED CASES OF PNEUMOCOCCIC ARTHRITIS—Continued

Case	Reference	Date	Age	Sex	Seat of arthritis	Relation of pneumonia	Nature	Complications	Treatment of joint	Functional result	Recovery or death	Remarks
40	McDonald ¹⁰	1898	15	M	Hip	None	Suppurative	General sepsis	Arthrotomy		D	Suppurative joint following injury
41	Quier ¹¹	1898	24	M	Knee	Pneumonia	Suppurative	Meningitis and double pneumonia, septicaemia	Arthrotomy		D	
42	Pettit ¹²	1898	42	M	L knee	Pn 5 days before crisis	Suppurative	Meningitis	Arthrotomy		D	
43	Uckmar ¹³	1898	A	M	Rt shoulder	Pn 5 days before	Suppurative		Aspiration only and arthrotomy	Perfect	R	
44	Widal and Leduc ¹⁴	1898	68	M	L sternoclavicular	None	Suppurative	Endocarditis, peritonitis, pleurisy, meningitis	Repeated aspirations?		R	Chronic rheumatic
45	Leroux ¹⁵	1899	45	M	L wrist	Pn 9 days before	Suppurative	Suppurative meningitis	?		D	
46	Preble ¹⁶	1899	43	F	Knee ankle, wrist and elbows	None	Suppurative	Suppurative meningitis, general pneumococcus, bacteremia	?		D	
47	Preble ¹⁶	1899	33	M	Knee, elbow wrist and metacarpophalangeal	Pneumonia	?		?		D	
48	Sorell ¹⁷	1899	48	M	L shoulder	Pn 8 days before	Suppurative	Empyema	?		D	Injured left shoulder and knee one day before onset of arthritis Old rheumatic
49	Billings ¹⁸	1900	23	M	Rt shoulder left knee, metatarsophalangeal	Pneumonia	Suppurative		O		D	
50	Fernet and Lacapere ¹⁹	1900	47	M	Rt wrist	Pn 3 days before	Serous		?	Stiff joint	R	
51	Lop and Bonus ²⁰	1900	28	F	Rt wrist	Pn 8 days later	Suppurative	Peritonitis, suppurative parotitis	Arthrotomy		R	Followed labor and peritonitis Pneumococcus vaginal discharge
52	Rendu ²¹	1900	66	M	L knee 1 sternoclavicular	Pn 15 days before	Serous and suppurative		Arthrotomy		R	

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53	Agathos ¹	1901	60	M	L sternoclavicular	Pneumonia	Suppurative		Arthrotomy		R
54	Agathos ¹	1901	63	M	L wrist	Pn 10 days before	Suppurative	Empyema, pericarditis	Arthrotomy		R
55	Allen and Lull ²	1901	40	F	L knee	None	Suppurative		Arthrotomy, amputation	Primary case	D
56	Anzilotti ⁴	1901	50	M	L knee	Pneumonia	Suppurative	Acute nephritis, pleurisy, decubital gangrene	Arthrotomy		D
57	Cave ¹¹	1901	51	M	L shoulder	Pn 9 days before	Suppurative		O	Injury to shoulder	D
58	Lannois and Paris ¹²	1901	46	M	Rt wrist	Followed pn	?	Endocarditis	?		D
59	Raw ¹¹¹	1901	28	M	Rt sternoclavicular	Pn 3 days before	Suppurative	Rt otitis media, abscess of thigh	Arthrotomy		R
60	Raw ¹¹¹	1901	52	M	Rt ankle	Pn 2 days before	Suppurative	Rt empyema	Arthrotomy	Stiff joint	R
61	Raw ¹¹¹	1901	49	F	Rt shoulder	Pn 2 days before	Suppurative	Rt empyema, cellulitis	Arthrotomy		D
62	Raw ¹¹¹	1901	23	M	Rt knee	Pn 2 days before	Serous		Aspiration	Useful joint	R
63	Raw ¹¹¹	1901	51	M	Both knees	Pn 6 days before	Serous	Severe toxæmia, generalized infection	Aspiration		D
64	Raw ¹¹¹	1901	58	M	Rt knee	Pn 3 days before	Suppurative	Arthrotomy	Arthrotomy	Stiff joint but useful	R
65	Raw ¹¹¹	1901	42	M	Rt shoulder	Pneumonia	Suppurative	Severe general infection	O		D
66	Barnard ⁶	1902	14	M	Rt knee	None	Suppurative		Arthrotomy	Followed influenza	R
67	Bicht and Goepfert ¹²	1902	8 mo	F	Rt knee	Broncho-pn	Suppurative		Arthrotomy	Perfect	R
68	Bicht and Goepfert ¹²	1902	11 mo	F	Rt knee	Broncho-pn	Suppurative	Meningitis	Exploratory puncture		?
69	Cole ¹³	1902	50	M	Ankle	Pn 12 days before	Suppurative	Endocarditis	Aspiration, arthrotomy	Left hospital against advice	R
70	Cole ⁶	1902	55	M	Both knees and ankles	Pn later	Suppurative	Septicæmia and meningitis		Leucocytes 15,000	D
71	Gullard ¹⁴	1902	63	M	Rt knee	Pneumonia	Suppurative	Endocarditis	Aspiration, arthrotomy, amputation	Old arthritis deformans	D
72	Gilty ¹⁵	1902	31	M	Rt knee	Pneumonia	Suppurative	In extremis	?	Chronic alcoholic	D
73	Hektoen ¹⁶	1902	47	M	L knee	Pneumonia	Suppurative		Aspiration		D
74	Herrick ¹⁶	1902	32	M	L elbow	Pn 7 days before	Suppurative		Repeated aspirations	Alcoholic	R
75	Herrick ¹⁶	1902	41	M	L knee	Pn 2 weeks before	Serous	Dry pericarditis	Free motion		R
76	Herrick ¹⁶	1902	26	M	Rt knee	Pn crisis 8 days before	Suppurative	Pericarditis severe toxæmia	Useful knee	Alcoholic	R
									Arthrotomy	Injured knee one month previously	D

Injured knee one month previously

CHRONOLOGIC TABLE OF REPORTED CASES OF PNEUMOCOCCIC ARTHRITIS—Continued

No	Reporter	Date	Age	Sex	Seat of arthritis	Relation of pneumonia	Nature	Complications	Treatment of joint	Functional result	Recovery or death	Remarks
77	Müller ¹⁸	1902	A	M	Rt wrist	Followed pn	Serous	Double otitis me-	O	Stiff joint	R	
78	Pfisterer ¹⁸	1902	8 mo	F	Both wrists and left knee	Broncho-pn	Suppurative	dia, suppurative meningitis, nephritis	?		D	
79	Pfisterer ¹⁸	1902	13 mo	M	Hip	Pn 10 days before	Suppurative		Arthrotomy		R	Old rheumatism
80	Quinell ¹⁸	1902	30	F	Rt sternoclavicular	Pn 7 days before	Suppurative	Endocarditis, nephritis	Arthrotomy		D	
81	Siredey and Couderc ¹⁹	1902	25	F	Metacarpophalangeal	Pneumonia	Suppurative	Pneocarditis	?		D	
82	Spittas ¹⁸	1902	17 mo	F	L elbow	Pn 10 days before	Suppurative	Empyema, meningitis	Aspirations		D	
83	Wells ¹⁸	1902	32	F	L sternoclavicular	Pn 9 days before	Suppurative		Arthrotomy		R	
84	Dudgeon and Branson ²⁰	1903	5 mo	F	L knee	None	Suppurative	Bronchitis	Arthrotomy		D	Secondary to otitis media
85	Dudgeon and Branson ²⁰	1903	6	M	L knee, r hip and wrist	None	Suppurative	Asthma	Arthrotomy		D	
86	Dudgeon and Branson ²⁰	1903	6 mo		Knee interphalangeal (hand)	None	Suppurative		Arthrotomy		D	
87	Dudgeon and Branson ²⁰	1903	14 mo	M	Rt elbow	Pn 2 weeks before	Suppurative		Arthrotomy		R	
88	Dudgeon and Branson ²⁰	1903	21 mo		Rt hip	None	Suppurative		Arthrotomy	Dislocated joint	R	Secondary to measles
89	Finkelstein	1903	13	M	Hip	None	Suppurative	Suppurative meningitis	Aspirated		D	
90	Howard ²¹	1903	42	M	Rt shoulder, rt ankle	Pn 7 days before	Suppurative	Pericarditis, endocarditis, meningitis	O		D	
91	Howard ²¹	1903	79	M	Both knees, l shoulder	Pn 7 days before	Suppurative	Meningitis	O		D	
92	Howard ²¹	1903	69	F	Knee	Pn 10 days before	Suppurative	Acute endocarditis	O		D	
93	Meyer ²²	1903	21 mo	M	L ankle	None	Suppurative		Arthrotomy		R	Secondary to varicella

		1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915
94	Meyer ²⁹	1903	16 mo	F	R shoulder	None	Suppurative	Aspiration	Aspiration	R				
95	Meyer ³²	1903	36	F	L shoulder and 1 hip	Pneumonia	Suppurative	Arthrotomy	Arthrotomy	R				
96	Pacchioni ¹⁰⁰	1903	2½	F	Both hips, 1 shoulder	Pn 3 weeks before	?	Pneumococcus vaginitis	Aspiration	R				
97	Raw ¹¹²	1903	41	F	Temporo-maxillary	Pneumonia	Suppurative	Arthrotomy	Arthrotomy	R				
98	Salmon ¹¹⁷	1903	2½ mo	F	Large joints	None	Suppurative	Congenital lues		D				Primary case
99	Schuster ¹¹⁸	1903	A	M	Rt elbow	Pn 20 years before	Suppurative	Arthrotomy	Arthrotomy	D				
100	Simonini ¹¹⁹	1903	3 mo	F	Rt knee, small joints of foot	Pn 4 days before	Suppurative	Arthrotomy	Arthrotomy	D				Pneumococcus in urine
101	Simonini ¹²⁰	1903	9	F	Wrist, ankle, knee, shoulder	None	Serous and suppurative	Aspiration, arthrotomy	Aspiration, arthrotomy	R				Pneumococcus in urine secondary to pharynx and tonsils
102	Simonini ¹²²	1903	4½	F	Rt wrist, 1 elbow	Pn 6 days before	Suppurative	Aspiration	Aspiration	R				Pneumococcus in urine
103	Slaughter ¹²³	1903	15	M	Rt knee	Pn 2 weeks before	Suppurative	Arthrotomy, amputation	Arthrotomy, amputation	R				Pneumococcus infection of tuberculous joint
104	Tubby ¹²⁴	1903	14 wk	M	Rt knee	None	Suppurative	Arthrotomy	Arthrotomy	R				Primary case
105	Brunn ¹⁷	1904	11 mo	F	Rt knee	None	Suppurative	Arthrotomy	Arthrotomy	R				Primary case
106	Brunn ¹⁷	1904	16	F	Rt knee	None	Suppurative	Arthrotomy	Arthrotomy	R				Primary case
107	Cabanes ¹³	1904	22 d	M	L ankle, knee and shoulder	None	Suppurative	Arthrotomy	Arthrotomy	R				Secondary to suppuration at umbilicus
108	Ciechomski ¹¹	1904	5½	F	Rt wrist and hip	None	?	Arthrotomy	?	R				Secondary to otitis and co-ryza
109	Davis and Brown ³	1904	8	F	Rt knee	Pn 1 day before	Suppurative	Arthrotomy	Arthrotomy	R				
110	Davis and Brown ³	1904	13	F	Rt sternoclavicular and wrist	None	Suppurative	Empyema, suppurative peritonitis	Arthrotomy	R				
111	Goldthwaite ¹⁰	1904	5		Shoulder	?	Suppurative	Splenic and renal infarcts, pericarditis and endocarditis	?	D				Secondary to otitis media
112	Krokiewicz ⁷⁰	1904	28	M	Shoulder	Pn 6 days before	Suppurative	Suppurative	Arthrotomy	R				
113	Segré ¹¹¹	1904	18	M	Rt foot, left shoulder	None	Suppurative	Suppurative	Arthrotomy	D				
114	Segré ¹¹¹	1904	51	M	Knee	None	Suppurative	Arthrotomy	Arthrotomy	R				Followed injury to joint from fall
115	Cohen ²³	1905	30	F	Ankle	None	Suppurative	Arthrotomy	Arthrotomy	R				Old rheumatic pyosalpinx and umbilical fistula

CHRONOLOGIC TABLE OF REPORTED CASES OF PNEUMOCOCCIC ARTHRITIS—Continued

No	Reporter	Date	Age	Sex	Seat of arthritis	Relation of pneumonia	Nature	Complications	Treatment of joint	Functional result	Recovery or death	Remarks
116	Illy ¹²	1905	4	M	L hip	Pn 9 days before	Suppurative	Suppurative pleurisy	Aspiration arthrotomy		D	Leucocytes 24 400 bone eroded
117	Pornaci ¹⁰	1905	28	F	Rt knee	None	Suppurative		Repeated aspirations		R	Probably secondary to throat infection
118	Nathan Turner ¹¹	1905	Inf t	M	Rt shoulder	None	Suppurative		O		D	Followed operation for hare lip Pure pneumococcus culture from both joint and lip wound
119	Roos ¹⁴	1905	30	M	Multiple	Pn 4 days later	Serous		O		R	
120	Witt ¹³	1905	36	M	Rt knee	Pn 17 days before	Suppurative	Empyema, septic thrombus, rt arm	Aspirated		D	
121	Berghin ¹⁵	1906	11 days	L	sternoclavicular, rt hip	Broncho pn	Suppurative	Suppurative pleurisy	?		D	
122	Chatterji ¹	1906	28	M	Rt knee	Pn 6 days before	Suppurative		Arthrotomy	Partial stiff joint	R	Left hospital against advice
123	Chatterji ¹	1906	40	M	Rt knee	Pn 4 days before	Suppurative		Aspiration		?	Necrosis of bone, leucocytes 125,000-150,000
124	Chatterji ¹	1906	57	M	L shoulder	Pneumonia	Suppurative		Arthrotomy	Ankylosis	R	
125	Ghedini ¹⁷	1906	50	M	L sternoclavicular	Pn few days before	Suppurative		Arthrotomy		R	
126	Greathend ¹⁸	1906	4	M	Rt knee	After pn	Suppurative	Septicæmia	Arthrotomy		R	
127	Herzog ¹⁷	1906	9	F	Wrists	None	Serous		?		D	
128	Herzog ¹⁷	1906	5 mo	F	Both shoulders, l knee	Broncho-pn	Suppurative		Arthrotomy		D	Primary pneumonia a terminal event
129	Herzog ¹⁷	1906	1	F	L hip	Broncho pn	Suppurative	Rickets	Arthrotomy	Good function	R	
130	Herzog ¹⁷	1906	8 mo	F	Rt hip	Pn 3 weeks before	Suppurative		Arthrotomy	Good function	R	
131	Howard ¹⁶	1906			Rt shoulder and l ankle	?	Suppurative	Peri- and endocarditis	?		D	
132	McGlannon ¹⁷	1906	35	M	Rt ankle	Pn 7 days before	Suppurative		Arthrotomy	Movable joint	R	

[illegible]

CHRONOLOGIC TABLE OF REPORTED CASES OF PNEUMOCOCCIC ARTHRITIS—Continued

No	Reporter	Date	Age	Sex	Seat of arthritis	Relation of pneumonia	Nature	Complications	Treatment of joint	Functional result	Recovery or death	Remarks
157	Low ¹	1908	A	M	Multiple	None	Serous	Pneumococcus cystitis	Autogenous vaccine	Good function,	R	Secondary to pneumococcus cystitis
158	Matthews ¹⁵	1908	34	M	Rt shoulder	Pn 9 days before	Suppurative	Acute endocarditis	Arthrotomy		D	
159	LaPetr ¹⁶	1909	8 mo	F	Knee	Pn 7 weeks before	Suppurative	Meningitis	Arthrotomy		D	
160	Letulle and Leconte ¹⁷	1909	41	M	L ankle	Pneumonia	Suppurative	Suppurative thyroiditis, multiple abscess	Arthrotomy		R	Very alcoholic
161	Strickler ¹⁸	1909	25	F	Knee	?	Serous		Aspiration	Partial still joint	R	Old syphilis
162	Adenot ¹	1910	41	M	Rt knee	Pn 14 days before	Suppurative		Aspiration	Fairly useful joint	R	Secondary to trauma
163	Jaboulay ¹⁹	1910	A	M	Elbow	Pneumonia	Suppurative	Pneumococcus abscess of buttock and calf of leg	?		?	Congenital syphilis
164	Koplik ²⁰	1910	Inf't	F	?	Broncho-pn	Suppurative		?		D	
165	Leclerc and Favre ²¹	1910	32	F	Rt elbow	Pn 11 days before	Suppurative	Pneumococcus abscess of buttock and calf of leg	O		D	Old rheumatism
166	McCorduck ²²	1910	16	F	L shoulder	None	Suppurative	Pneumococcus abscess of buttock and calf of leg	O		D	Old rheumatic
167	McCorduck ²³	1910	16	F	L ankle	Pn few days after	Serous	Pneumococcus abscess of buttock and calf of leg	O		D	Previous rheumatism
168	McCorduck ²⁴	1910	13	F	L shoulder	Pn 6 days before	Serous	Pneumococcus abscess of buttock and calf of leg	O		D	
169	McCorduck ²⁵	1910	14	F	Both knees	None	Serous	Pneumococcus abscess of buttock and calf of leg	Aspiration		?	
170	Trevisanelloni ²⁶	1911	A	M	Left knee	Pn 9 days before	Suppurative	Pneumococcus abscess of buttock and calf of leg	Arthrotomy	Joint deformity	R	Secondary to gastro-enteritis
171	Edberg ²⁷	1913	3 wk	F	Rt hip	None	Suppurative	Pneumococcus abscess of buttock and calf of leg	Arthrotomy		R	Secondary to ileocolitis
172	Edberg ²⁸	1913	2 mo	F	Both hips	None	Suppurative	Pneumococcus abscess of buttock and calf of leg	Aspiration, arthrotomy	Perfect function	R	
173	Bulkley	1913	11 mo	F	Rt shoulder	Pn 2 weeks before	Suppurative	Pneumococcus abscess of buttock and calf of leg	Aspiration, arthrotomy	Perfect function	R	

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The following articles also contain references to the subject, and from their titles some of them undoubtedly contain case reports. We have unfortunately been unable to obtain access to any of them

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covering of the cæcum and appendix fit in well with the explanation of the embryonal origin of these membranes, since their fusions, adhesions, and contractures are doubtless directly or indirectly due to inflammation, so that the final solution of the problem of the origin of the conditions known as Lane's kink and Jackson's membrane will properly be represented by the sum of the views of various observers

My original paper was based upon a study of six cases in which membranous formations, covering in varying degrees some part of the colon, and crippling its function more or less, were found present when the parts were exposed by abdominal section. For the purposes of an orderly and complete presentation of the material thus far accumulated, I will here give a condensed abstract of these cases as follows

CASE I—A woman over forty years of age, the onset of whose symptoms dated back only three months from the day when operation showed her to be the subject of a chronic appendicitis and membranous pericolitis. A right-sided perinephritic infection complicated this case, which was most plausibly explained as due to infection carried by the lymphatic paths from the region of the cæcum and ascending colon

CASE II—A woman twenty-four years of age, who in addition to a definite membranous film covering the cæcum and ascending colon was the subject of chronic appendicitis, chronic salpingitis, and chronic ovaritis

CASE III—A man, thirty-seven years of age, who as a youth or young man had enjoyed good health and displayed more than the average activity and energy in his work. When he was thirty-two years of age, an acute appendical attack ushered in the symptoms of right-sided disturbance, which were not relieved by the removal of the appendix, and persisted for five years, until he came to operation

CASE IV—Patient was a large, athletic, and finely developed man, who had always pursued an outdoor occupation. At the age of twenty-seven he developed an acute appendicitis, for which he was operated upon, making an apparently uncomplicated recovery. From that time, however, began a train of symptoms running through a period of seven years until he finally came to operation

INCIDENCE OF GALL-STONES AND OTHER CALCULI AMONG LABORERS IN THE PANAMA CANAL ZONE.*

BY H. C. CLARK, M D,

OF ANCON, CANAL ZONE

(From the Board of Health Laboratories)

THE labor force employed by the Isthmian Canal Commission is chiefly drawn from the negro population of the West Indies, therefore abundant opportunity is offered at Ancon Hospital for an anatomical study of young male negroes. Findings not infrequently occur here which are so at variance with the old ideas in regard to the influence of race, sex, age, and climate, that it is interesting to group certain factors for comparison and study.

A supposed immunity has always been granted the negro in respect to gall-stones. Keen¹ writes as follows: "I formerly thought gall-stones occurred in full-blooded negroes with extreme rarity. During fifteen years of practice in Louisville, Ky, I never saw a case in the colored race."

After ten years' experience in five of Philadelphia's hospitals, he later claims to have seen only one case. His correspondence with other surgeons, many of them in Southern States, led to almost the same findings. Pennsylvania Hospital, located in a portion of the city of Philadelphia near a large settlement of negroes, was able to report to him a few cases.

The negro apparently enjoys the same reputation with reference to urinary calculi, but is admitted to be less immune to vesical calculi, although the latter is reported by one authority to occur once in 55,305 blacks.

Osler² states that biliary calculi probably occur in from five to ten per cent. of all autopsies in the temperate zone, being uncommon in the tropics. Hektoen and Riesman³ claim

* Permission for publication granted by the Acting Chief Sanitary Officer, Colonel John L. Phillips, U S A, M C. Thanks are due Dr Samuel T. Darling for many helpful suggestions.

that biliary calculi, after the sixteenth year, are found in 25 per cent of all bodies Naunyn, in more than 9000 autopsies, finds that one case in every thirty had calculi

All authorities seem to agree that the primitive races are possessed of a high degree of immunity from calculous formations

Having recently completed a series of 1500 consecutive post-mortem examinations at Ancon Hospital, a review was made to determine the frequency of calculi of various types Thirty-nine instances of biliary calculi were found, and classified with reference to race as follows

Race	Autopsies	Biliary Calculi	Per cent
West Indian negro	1088	24	2 2+
Spanish—Indian (mixture)	230	9	3 9+
Spain (white)	108	3	2 7+
U S A (white)	25	1	
Italy (white)	17	0	
Greece (white)	7	0	
China (white)	6	0	
England (white)	5	0	
Germany (white)	3	0	
France (white)	3	1	
Unknown	8	0	

In classifying according to age and sex, the Ancon Hospital series will be compared with the Pennsylvania Hospital (Philadelphia) series reported to Dr Keen by Dr W T Longcope

	Autopsies Pennsyl- vania Hospital	Autopsies Ancon Hospital	Pennsylvania Hospital	Ancon Hospital
Under 30 years of age	1	11	Males 15	Males 28
From 30 to 40	5	12	Females 16	Females 11
From 41 to 50	14	8		
From 51 to 60	6	3		
From 61 to 70	4	4		
Over 70	1	1		
Total	31	39	31	39

Pennsylvania Hospital Number of autopsies in series, 1050
Ancon Hospital Number of autopsies in series, 1500

This shows for the Pennsylvania Hospital a percentage of 2 95 + and for Ancon Hospital 2 6 No race entry was given in the Pennsylvania Hospital report, but a personal acquaint-

ance with that institution enables me to state that they deal principally with the white race

No safe deductions can be made from a comparison of the age grouping in these two lists, for as has already been stated the Ancon series contains chiefly young male negroes. It is interesting to note, however, the number that has been found in the earlier decades of life. Considering the small number of females autopsied at Ancon Hospital it would appear that the females of the tropics would bear out the old idea of the prevalence of biliary calculi in their sex. Naunyn's theory that gall-stones are the result of a pathological alteration in the mucous membrane of the gall-bladder usually excited by the presence of bacteria, and leading to an increased deposition of lime and cholesterol, has met with general acceptance. Many instances are recorded which show that local infection is the chief factor in bringing about biliary lithiasis. If this is the case, then the negro of the tropics is thrown open to more etiological factors because he is often subjected to various forms of enteritis and colitis, which frequently run a chronic course. He is also exposed to the influence of such diseases as malarial hæmoglobinuria in which pathological conditions in the biliary passages have been noted. Thus several additional factors may be at work in the tropics that are not encountered in the temperate zones.

An effort has been made to group the causes of death in the cases revealing gall-stones and also to group the evidences, past or present, of chronic infections which might throw light on the etiology. The causes of death in the 39 cases are as follows

Lobar pneumonia,	7	Mental diseases,	2
Pyæmia,	4	Dysentery,	1
Intestinal obstruction,	3	Hæmoglobinuric fever,	1
Chronic nephritis,	3	Gastric and duodenal ulcers,	1
Tuberculosis,	3	Apoplexy,	1
Traumatism,	3	Aneurism,	1
Purulent infection of genito-urinary system,	2	Senility,	1
Cardiac diseases,	2	Anæmia,	1
Meningitis,	2	Diabetes mellitus,	1

Classification of other findings, occurring singly or in some combination, which may represent the origin of the influences predisposing to gall-stone formation

Chronic adhesive perihepatitis and perisplenitis	14 times
Pelvic diseases of chronic inflammatory nature	5 times
Chronic fibrous peritonitis, general	5 times
Chronic ulcerative colitis	5 times
Chronic ulcers or cicatrices in duodenum and stomach	4 times
Chronic ulcers and cicatrices in ileum and cæcum	1 time
Hernia, inguinal	2 times
Fibromyomata uteri (large masses)	3 times
Multiple pregnancy	1 time
Pancreatic disease	1 time
Cases with negative histories and no old lesions	8 times

In none of these cases would it seem likely that gall-stones had played a part in the cause of death unless it be that the pancreatic disease present in the case of diabetes mellitus was a sequel to the cholelithiasis

To the list of predisposing factors may be added the note that in most all of the cases malarial pigment was present in spleen, liver, and marrow. In malarial hæmoglobinuria marked inspissation of the bile occurs. It is not unlikely that such an influence or condition may be an etiological factor in the causation of gall-stone in the tropics

In the series of 1500 autopsies, scars or ulcers were found in the stomach 31 times and in the duodenum 25 times. Reference to the tables given will show that ulcers of the duodenum and stomach had been a cause of death in one instance where gall-stones had been found, and in the table of predisposing factors one sees the entry of ulcers and cicatrices four times, and of intestinal lesions eight times. Peritoneal infections, ascending intestinal or local intestinal infections would appear to be very important factors. Large masses of myofibromata and pregnancy in a mechanical way might produce stagnation of the bile

It is difficult to draw conclusions as to the incidence of gall-stones in the tropics, but it is evident that the Ancon Hospital series offers proof that the black man from the West Indies furnishes a greater percentage of cases of biliary

calculi than does his brother of the temperate zone. The clinical records at Ancon Hospital lend further proof of this, for not infrequently cholelithiasis has been the indication for surgical intervention. The attention being paid to the coincidence of gall-stones with other surgical diseases is well shown by a recent review of the laparotomies done in the service of each of three American surgeons. Dr J. G. Clark⁴ finds 27 instances of gall-stones associated with myoma uteri, 56 instances with other abdominal conditions chiefly of a pelvic nature. Dr C. H. Mayo⁵ records 1244 operations for myoma uteri in which there were 90 cases of coincident cholelithiasis. Dr Philemon Truesdale⁶ reports 500 laparotomies for pelvic conditions with 34 instances of associated gall-stones.

It would appear from this that Dr Osler's statement in regard to biliary calculi as probably occurring in from 5 to 10 per cent of all autopsies in the temperate zone would indicate the general prevalence. Since the analysis of the Ancon series another case of special interest has fallen into my hands which seems to deserve a brief note.

Case 139,790 was a black, male child of four months, which died of acute enterocolitis and as a contributing factor possessed a congenital cardiac defect, a patent foramen ovale, with hypertrophy of the right side of the heart. Cholelithiasis was a coincident factor. The gall-bladder was under some tension from its content of clear watery fluid. When this escaped two gall-stones were found. Each was about twice the size of a wheat grain and black in color. One was loosely engaged in the cystic duct at its entrance and the other free in the gall-bladder. The ducts were patulous.

The combined weight of the two stones was 0.0295 grammes. They were subjected to a chemical examination by Mr J. E. Jacob. The results, in brief, indicated a formation due to biliary pigments and some calcium oxalate. Cholesterol was absent.

Osler states that cholelithiasis is rarely encountered in infancy and childhood and that when it does occur it is doubtless due to intra-uterine infection. Maternal history in this instance was of no aid but the anatomical findings would in-

dicating an ascending intestinal infection as the etiological factor were it not for the extreme youth. It, at least, raises the question of the time required for such formations to occur.

Attention is directed to the disproportionate incidence of gall-stones among the cases of pyæmia and of intestinal obstruction.

Pyæmia (4 cases) and intestinal obstruction (3 cases) occupy an unusually conspicuous place as a cause of death in this series without being directly related to the gall-stone condition.

It seems possible that the causes favoring gall-stone would favor pyæmia, and on the other hand the cause favoring intestinal obstruction by favoring infection would further the processes leading to gall-stones.

The association of hernia might also be classed as an etiological factor because even moderate occasional constriction of the bowel favors the entrance of intestinal bacteria into the blood stream.

LITHIASIS OF THE URINARY PASSAGES
Tabulated Cases

Race	Age	Sex	Location of Calculus
West Indian, negro	47 years	Male	Three or four calculi in each kidney
West Indian, negro	21 years	Male	Right kidney
West Indian, negro	70 years	Male	Vesical calculus (prostatic disease).
West Indian, negro	68 years	Male	1 small stone—pyramids calcified.
West Indian, negro	4 days	Male	Calcification of the pyramids
West Indian, negro	11 days	Male	Calcification of the pyramids
U S A, negro	43 years	Male	Bilateral ureteral calculi
Spanish, Indian	87 years	Male	Vesical calculus (prostatic disease).

In these instances urinary lithiasis was only found in the male sex.

The number of negroes and individuals of Spanish-Indian mixture in this series of 1500 is 1318, the cases revealing some type of urinary lithiasis being eight. The clinical records at Ancon Hospital show a corresponding dearth in the negro.

In the two black male babies the condition manifested itself in the form of a "sand deposit" in the pelvis of each kidney and in the pyramids. It was so marked that the condition

seemed worthy of special mention. This has been frequently noted, though, to a less degree in babies and very old people, and also in certain cases of chronic nephritis. Holt,⁷ basing his statement on 1000 autopsies on infants, states that granular deposits are generally seen in both kidneys, the pyramids not infrequently are calcified and rarely a calculus found.

In the two cases of vesical calculus extreme age and prostatic disease were present. In both instances a large soft stone was found.

The most interesting case of the series is the one tabulated as bilateral ureteral calculi. This was in a male negro laborer, forty-three years of age, from Virginia, who had lived for the past five years in a suburban division of Panama City. In each ureter a calculus was found at autopsy (A-3195) lodged just above the brim of the pelvis. The anatomical findings were chiefly cardiovascular and renal, with hydronephrosis superimposed. Syphilitic aortitis and small gummata in the liver were also found. In the left ureter there was found at the pelvic brim a calculus measuring 7 mm in diameter and about 2 cm long. In the right ureter at a similar point was another calculus 7 mm by 1 cm.

The dried ureteral calculi were given to Mr. J. E. Jacob for chemical analysis. His report is appended: "The two calculi weighed approximately 0.6 grammes each. The cross-section of the calculi showed alternate layers of yellowish and yellowish-red material. They were found to be composed principally of uric acid with a small amount of ammonium urate. A trace of albuminous matter and ether soluble substance was also present."

Albarran⁸ regards the presence of stone on both sides as an argument in favor of the systemic origin of renal calculi, the fact that they are not always found on both sides being due to the absence on one side of a nucleus upon which to deposit crystals, or to the calculus being voided before reaching considerable size, and in some instances to the ureter dilating and allowing even a large stone to pass into the bladder. The skiagraph in many instances reveals bilateral calculi, thus bearing out his view.

Lusk,⁹ Mendel,¹⁰ and others in their study of the formation and elimination of uric acid lend supporting evidence to the systemic origin of calculi

Pancreatic Calculi—This type occurred twice in the series. Once in a male negro of 21 years associated with biliary calculi in the cystic duct and extensive acute and chronic pancreatitis, diabetes mellitus being a sequel. Two long cylindrical calculi were found lying end to end in the dilated ducts about the middle of the pancreatic body.

The second occurrence was in a male negro of 44 years. Here a most extensive chronic interstitial pancreatitis was found with focal areas of acute pancreatitis wherever large tufts of tissue remained. No glycosuria was associated. The concretions were found throughout the organ in the form of shot-like collections of sand. Two cases of pancreatic calculi have been reported in a series of 1500 autopsies at Johns Hopkins Hospital. They are said to be infrequently met with, though I can find no other records at hand which would give an idea of the incidence of these calculi.

Salivary Calculi—None appeared in the autopsy series but one instance was found in the surgical service of Dr. A. B. Herrick and is sufficiently rare to merit recording. A bullet-like calculus was found in the submaxillary gland removed from a male Barbadian negro of twenty-eight years. A ranula had formed and a superimposed acute and chronic inflammatory process was found. Mr. J. E. Jacob's report on the calculus was as follows: weight 0.4320 grammes, composition chiefly calcium and ammonium phosphates, traces of sodium, iron, phosphoric acid, and albuminous matter also present.

These concretions are said to occur five times more frequently in the submaxillary than in any of the other salivary glands.

Concretions of the Tonsil—Infrequently the tonsillar crypts have contained irregular concretions probably resulting from diseases which have closed the exit of the crypts and allowed a calcareous degeneration to follow. These have sometimes had a diameter of from 4 mm. to 8 mm.

Appendiceal Concretions—The occasional foreign body in the centre of concretions found elsewhere has to a certain extent been noted at Ancon. The only noteworthy exceptions that have attracted attention were two cases. one in which the dead body of an uncinaria or tricocephalus worm formed the nucleus and a second instance where several ova of *Trichuris trichiura* occupied the centre of a dried concretion.

SUMMARY—(1) The findings at this hospital indicate a much less frequent occurrence of biliary calculi in the negro than in the white race living in the temperate zone, but they tend also to show a much greater incidence in the negro of the tropics than in his brother of the temperate zone.

(2) Suggestive factors relative to etiology are the prevalence of enteritis, colitis, and malaria, especially the intestinal diseases.

(3) Ancon Hospital findings would also indicate a higher percentage of cholelithiasis among the Old World Spaniards than authorities are willing to grant.

(4) Calculi of the urinary passages in the negro would appear to be extremely rare.

(5) One case lends argument in favor of the systemic origin of renal calculi.

(6) Intestinal nematodes may directly be the etiological factor in certain cases of appendicitis associated with fecal concretions by producing a portal of entry for infection in the mucosa of the appendix, or indirectly by furnishing the nucleus for a concretion and its frequent sequel, appendicitis.

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is deserving of close study at this time particularly, when we are gradually entering into phases and treatment of diseases evolved from the physiology of internal secretions and fundamentally based on the pathology of the living rather than the dead.

JAMES T. PILCHER.

CARBON DIOXIDE SNOW. Its Therapeutic Uses. By J. HALL-EDWARDS. Birmingham, London: Simpkin, Marshall, Hamilton, Kent & Co., Ltd. 1913.

In this little volume the author sets forth the methods of collecting, preparing, transporting, and applying carbon dioxide snow in a clear and readable manner. In addition to giving the ordinary means of collecting the snow, the writer describes the apparatus which he has designed for the purpose. Application, effects, length of exposure, and what is necessary are gone into very thoroughly, and no cases treated has been purposely omitted, a list in which the snow may be successfully used is given, and the treatment of those conditions in which snow has been most extensively employed is described in detail. The printing is excellent; there are numerous illustrations, and the book may be commended as a reliable guide to those desirous of trying this form of treatment.

JOHN A. C. MACEWEN.

CORRESPONDENCE

THROMBOSIS OF THE MESENTERIC VESSELS.

EDITOR ANNALS OF SURGERY:

Inasmuch as thrombosis of the mesenteric vessels is so infrequently seen, so rarely diagnosed preceding exploratory laparotomy and post-mortem examination, and knowing that the mortality in this disease is so extremely high, 92 per cent. to 94 per cent. (Jackson), I thought it would be of interest to some one to report a case which was referred to me for operation May 6, 1913, by Dr. D. C. Perkins of Jamestown, N. Y.

Patient, Mrs. D., German, housewife, family history negative, mother of eight living children, the youngest five years of age. Patient had always been well up to about January 1, 1913, when she began to have an occasional attack of indigestion associated with vomiting, headache, coated tongue, abdominal pains and unusual constipation. Menstruation regular, piles, and occasionally noticed blood in stools. The above condition persisted, attacks re-occurring about every two weeks, until she entered The Jones General Hospital, Jamestown, N. Y., April 24, 1913, nearly four months after her first attack.

Patient's examination on entering hospital revealed a fairly well nourished woman, but who stated she had lost about fifteen pounds in weight in the previous three months. Physical examination negative, except coated tongue, slight tenderness over the whole abdomen and a few internal hemorrhoids. Temperature 99.5°, pulse 100, respiration 22, urine alkaline, specific gravity 10.18, no sugar, no albumin, complained of some abdominal cramps and did not care for diet.

During the twelve days following admission to hospital, the temperature varied between 99 and 100°, pulse between 90 and 120, respiration 20 to 25, daily vomiting spells, coated tongue, moderate abdominal pains, dark brown stools, and urine normal.

On the thirteenth day after admission, May 6, patient had a severe fainting spell at 10 A.M. after which complained of very severe pain in abdomen, vomited bile, pains continued until 7 P.M. when I was called in consultation. Patient very much under the influence of morphine, abdomen moderately distended and extremely tender, knees flexed, vomiting bile, temperature 99.4°, pulse 140, respiration 32. Diagnosis, obscure abdominal lesion. Patient was immediately prepared for operation.

disease which produces local deformity of the organ, interference with the complete emptying of the bladder, damage to the genito-urinary tract above and serious ill-health of the patient. The clinical indications of these are designated prostatism.

It is recognized that prostatism may arise from a variety of pathological lesions, the majority producing hypertrophy of the gland. All are of the nature of chronic prostatic disease, and at one period are amenable to direct operative treatment. The latter have been gradually evolved until to-day three main routes of access are employed: (1) the suprapubic—extra-peritoneal transvesical; (2) the perineal, and (3) the trans-urethral, the last being used for the division of the constrictor or prostatic punch.

ANATOMY OF THE PROSTATE GLAND.

Changes met with in the prostate gland in cases of prostatism vary widely and have a morbid anatomy that differs pronouncedly from the normal standard, so much so, that, if the operative treatment of prostatism is carried out solely on an anatomical basis, confusion arises and disaster is liable to follow.

I propose to describe these variations fully, but before doing so, shall refer to certain points in the normal anatomy that are of especial importance and the subject of controversy.

Lobes.—The number of lobes assigned to the prostate gland will depend on the method of anatomical description employed, but whether it be subdivided into two lateral lobes or separated into five segments, as I shall do in this paper, it must be borne in mind, that they form a homogeneous entity, and are fused into a single organ, and that in health, they are no more capable of individual enucleation by blind finger dissection, than are the lobes of the female breast. The gland envelopes the prostatic urethra, much the greater part of it being situated behind it, and is traversed by two channels, the urethra and the ejaculatory ducts, and these may be used to subdivide the gland into five segments. On either side of the urethra lie the *lateral lobes*, in front is the *anterior lobe*, the triangular wedge of gland tissue behind the urethra, and above the ejaculatory ducts forms the *middle lobe*, the corresponding portion below the *posterior lobe*.

Investing Membranes.—These are two in number, the capsule, and the

sheath. The term 'capsule' is used to designate the fibromuscular envelope that surrounds the gland intimately and sends septa into its substance, and is so intimately incorporated with it that it is normally absolutely incapable of separation from it by blunt dissection. The sheath is the outer fibrous investment loosely connected with the capsule of the prostate, except in front where the two membranes are intimately incorporated, and below where it is united to the neck of the gland. The sheath is usually described as being derived from the visceral layer of pelvic fascia, more particularly those divisions of it known as the "vesical" and "rectovesical" layers. Elliot Smith and Derry, following the French School of Anatomists, describe the prostatic sheath as having a three-fold origin. (1) In front it is derived entirely from the mesodermic tissue surrounding the blood-vessels of the prostatic plexus. (2) Puboprostatic true ligament is therefore essentially a vascular cord. Laterally this perivascular tissue also forms the sheath, but it is here reinforced by the fascia covering the inner aspect of the levator ani muscles. (3) Posteriorly it is formed by the fascia of Denonvillier, which is the obliterated lower limit of the rectovesical peritoneal pouch. This peritoneal fossa, in the new-born infant normally reaches as low as the lower limit of the prostate but later this portion of it is obliterated so that two loosely adherent sheets remain between the rectum and prostate and form Denonvillier's fascia.

I have studied the evolution and structure of the prostatic sheath in fifty subjects, the prostate being hardened *in situ*, embedded in celloidin and complete serial sections made with a Bruce's microtome, and confirm the accuracy of the above-mentioned description. The constituent elements of the sheath can be best observed in microscopic sections made of the pelvis of fetal, full-time, and recently-born male infants (Figs. 1-6). They are also easily observed in sections similarly made from the youth and the adult (Figs. 7 and 8).

The description appeals to me on the grounds of its simplicity, and the accompanying illustrations, selected from a large number, demonstrate its accuracy.

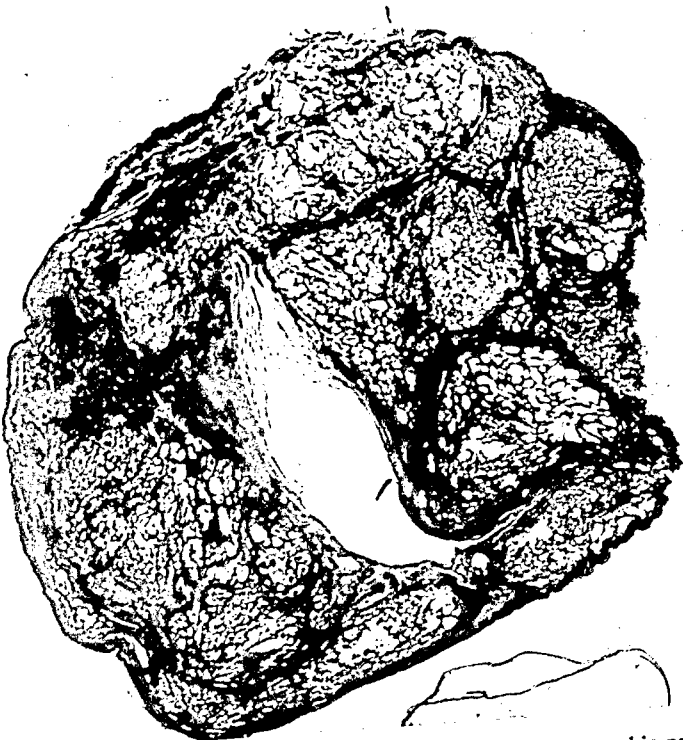
Blood-vessels.—The veins of the prostatic plexus are formed mainly from the dorsal vein of the penis which makes the vertical stem of a "Y" lying in front. The limbs of the "Y" pass backward and upward in the vesicoprostatic sulcus and receive the vesical veins as they course back to join the internal iliacs. Veins from the prostate enter the sinus especially in front. Laterally the vessels of the sinus are incorporated in the inner aspect of the sheath. From the point of view of damage to blood-vessels in prostatectomy, the dangerous area therefore lies in front (Figs. 7, 8 and 9).

FIG. 17.



Horizontal section of prostate and seminal vesicles showing the fascial investment of vesicles and its relationship to prostate and blood-vessels.

FIG. 18.



Horizontal section of prostate removed by the operation of suprapubic prostatectomy for chronic lobular prostatitis (prostatic hypertrophy). The prostate was smaller than natural size; but shows advanced disease.

When the prostate gland possesses the gross structure and relationships of the normal organ :

1. Total subcapsular enucleation by finger dissection is impossible.

2. Extracapsular enucleation by finger dissection is possible but an extremely difficult and dangerous proceeding.

3. Total excision necessitates a separation of the capsule from the sheath and as these are intimately incorporated in front the vessels of the prostatic plexus must be wounded.

4. To gain access to it from above by the suprapubic transvesical route necessitates division and possible destruction of the internal vesical sphincter, the normal prostate being an extravesical organ.

5. The external vesical sphincter will be damaged and possibly destroyed.

6. The space of Denonvillier must be opened up and as this is a very loosely obliterated peritoneal pouch, the retroperitoneal cellular tissue planes are in consequence opened as a path along which extravasated blood or an infecting virus may readily extend into the pelvic or extraperitoneal cellular tissue, if the space is not freely drained.

7. Conservation of the ejaculatory ducts is impossible in total excision by the transvesical route.

8. The seminal vesicles are likely to be damaged in enucleation and must be dissected free in excision.

PATHOLOGY OF PROSTATISM.

Incidence of Disease.—The frequency with which chronic prostatic disease producing prostatism occurs is difficult to estimate. Richardson states that chronic prostatic enlargement has been found in 34 per cent. of men over the age of sixty, and of that number 15 per cent. suffer from symptoms. Plondke has estimated that 33 per cent. of all men over 50 years of age suffer from enlarged prostate and that 10 per cent. of these require treatment. He also says that catheter life results in 100 per cent. mortality within an average period of 4 years. Personally I am unable to give accurate data not

tion was imperative. The question naturally arose whether to do a primary bone transplant or a secondary one. The objection to the former was that there would be an open communication between the transplant and the wound in the mouth, but inasmuch as the only risk involved would be the loss of a few inches of one of the ribs, this method of procedure was decided upon, and on October 16, 1913, the involved section of the lower jaw was removed, extending from the second bicuspid back to the angle of the jaw, and including all the diseased bone, together with the soft tissues beyond the limits of the tumor. Silk sutures were inserted in the mucous membrane, three layers of catgut sutures beneath, and every precaution was taken to protect the wound from the mouth secretions. The tenth right rib was then exposed, and a section, together with its outer periosteum, was removed, and after trimming it to the proper size, it was inserted to fill the gap in the lower maxilla. A hole was bored in the jaw anteriorly with a Hudson drill and the anterior end of the rib pushed into it like a dowel. The posterior end of the rib was split vertically and made to fork over the lower end of the ramus of the jaw. This arrangement made a mechanically firm new jaw.

On the ninth day after the operation the wound showed some evidences of infection, due to communication with the mouth. But in spite of this the transplant remained firm. Six weeks had elapsed since the operation, and while there was still a small amount of discharge, the bone transplant gave evidence of being permanent, with preservation of excellent function of the jaw. Pathologically, the tumor was an adamantinoma. X-ray pictures, taken after six weeks, showed the piece of rib still in perfect condition, and in the position originally placed.

PITUITARY TUMOR: FRAZIER OPERATION.

DR. JOHN F. ERDMANN presented a girl of fourteen who was admitted to the hospital on June 10, 1913, complaining chiefly of a loss of vision, which was practically complete, the patient being scarcely able to discern between daylight and darkness. Her family history was unimportant. In childhood, the girl had whooping-cough, measles, scarlatina and pleurisy, and she had suffered from occasional attacks of tonsillitis. Her present trouble began in February, 1913, when she first noticed that she could not read properly, often missing or repeating words and

lines, and when reading she noticed that the left side of the book would become blurred. For three months previous to that time she had noticed that she could not see the blackboard from her seat in the rear of the school-room, and she was finally compelled to move to the front row of seats in order to see what the teacher was writing. The eyesight gradually grew worse, and in February she was compelled to leave school. Two months later she awoke one morning practically blind, and since then she has had continuous visions of different objects before her eyes. In April she began to complain of severe headaches, especially on the left side. These were only temporary. Her appetite was fairly good and she slept well. She suffered from constipation; also occasional vomiting, accompanied by nausea and vertigo. An examination of the eyes made by Dr. John E. Virden showed complete double optic atrophy.

Five weeks ago, Dr. Erdmann said, he operated on this patient by the Frazier method. Upon exposing the frontal lobe, he found a large collection of fluid between the dura and the arachnoid, which was removed by puncturing the dura. Upon exposing the sella turcica it was apparently slightly enlarged, and in the region of the floor of the sella a dark, grayish object protruded, resembling portions of a cyst wall. This was extirpated as completely as possible, and the wound closed.

For four or five days following the operation, the patient was very irritable, with a temperature ranging between 103° and 106° . This gradually subsided, and she left the hospital two weeks later. At the present time the optic atrophy was still apparently complete, although the patient insisted that she could at times distinguish certain objects.

Pathologically, the specimen showed disintegration of the structure of the pituitary body, with fairly well marked chronic inflammatory changes and localized areas of hemorrhage. There was a considerable development of hyaline connective tissue, which formed the wall of the "cyst," and passed through both the anterior or prehypophysis and the intermediate portions of the gland. The lymphoid cells and some polynuclears also suggested the presence of inflammation. The normal histology of the gland was greatly distorted, and the epithelial cells of the anterior lobe were compressed. In some sections there were areas

anterior border with the convexity nearly at the posterior border, ending below at the anterior border again. The flap of skin is reflected off the periosteum beneath. A wide thin carpenter's chisel is as good an instrument as any to make the graft and there is no need of a more complicated circular motor saw. Measure the length of defect to be filled in and add to this sufficient length to dovetail each end into the corresponding medullary cavity of the fractured ends. With the chisel make transverse cuts at the anterior border of the tibia at each end of the part to be transplanted, one-half or three-quarters of an inch deep, the transplant being about as thick as one's forefinger. On the internal surface join the posterior end of each transverse cut by a longitudinal groove which is made by successive light blows of the mallet on the chisel directed outward, is moved along after each blow. This is to prevent slipping of the graft. Proceed deeper, the chisel being moved along the groove after each blow. By a longitudinal incision divide the tibialis anticus from the external surface of the tibia without injury to the periosteum, which is longitudinally incised at a distance the same as on the internal surface. Join the posterior ends of the transverse incisions in the bone by a longitudinal groove made on the external surface, the chisel being directed inward through the incision in the periosteum. Proceed deeper until the chisel enters the medullary cavity, then go to the opposite groove and carry this likewise into the medullary cavity. The graft is lifted out by an instrument and is never touched by the gloved hand. The graft should be placed into the defect made for it just as quickly as possible that its cells may not die from lack of nourishment. It should not be placed in salt solution as this washes away the little blood that is left on the graft to nourish its cells. Murphy's method is to enlarge the medullary cavities of the fragments with a reamer or burr for a distance sufficient to form a good firm bed for the graft. An equally good method is to make longitudinal furrows opposite to each other on the stumps, large enough to receive the graft. Drill holes are made through the fragments and graft and chromic gut sutures

are inserted through them and tied. Murphy prevents the graft from riding up the medullary cavity by inserting a nail through the fragments and graft, but it seems wise not to use any foreign body which may later irritate. It is not necessary for apposition to be maintained between the ends of the fragments of the fractured bone though this is desirable. In this way can be overcome the shortening of the extremity. The graft has periosteum on two of its surfaces and medullary tissue on the other and will positively live if asepsis be attained. Both wounds are closed without drainage and the fractured limb is immobilized.

BITTNER resected the lower half of the shaft of the tibia for sarcoma, leaving the lower epiphysis. He filled the gap by splitting longitudinally the remaining half of the shaft up into the tuberosity, turning the segment down and fixing it in place. Only 1.5 cm. shortening resulted and the leg was strong and useful.

SIEVERS (*Beitrag zur kl. Chir.*, vol. 85, Heft 1) reports having excised the mid-phalanx of the ring finger with its periosteum for sarcoma. He filled this defect by excising the first phalanx of the fourth left toe and transplanting this into the finger defect. The toe defect was filled by a graft from the tibia.

WITZEL (*Deut. Zeit. f. Chir.*, Bd. 121, H. 1, p. 180) reports two successful cases in which he substituted a part of the clavicle, resected for sarcoma, by the spine of the scapula.

PELS-LEUSDEN (*Chir. Operationslehre*, p. 222) says that *spina ventosa* should be treated by excision of the diaphysis with its periosteum and the defect should be filled in with a graft taken from the tibia with its periosteum.

3. *Transplantation with pedunculated bone flaps, either temporary or permanent.* This method is mentioned for the sake of completeness. It is a great question whether it has any advantages over free bone transplants which are uniformly successful if periosteum be on the graft, and if asepsis be attained. Certainly the conditions will be rare in which pedunculated bone flaps are required.

A. Ollier's operation *par renversement*, and excise the fibrous tissue between them. fragment a thin triangular slice of bone after The slice of bone is hinged by the periosteum line. The triangular wedge of bone is now it is sutured with chromic gut to the raw bone

Male, seventy-five years of age Had been a hale, vigorous, and active man Four years ago he had an acute digestive disturbance accompanied with vomiting and purging Two years later he began to experience in the splenic region a vague sense of discomfort which has continued to the present time At irregular intervals there would be exacerbations of pain with an accumulation of flatus in the colon and constipation, culminating in a diarrhoeal attack after which relief would follow for an indefinite time

During the month immediately previous to coming under our care this condition of intestinal irregularity had been quite marked All his trouble subjectively was localized in the region of the splenic flexure The tendency to constipation was marked When cathartics were taken and these were effectual in moving the bowels, relief to his subjective symptoms followed for the time being Abdominal palpation was negative with the exception that there was a fixed point of moderate tenderness on the outer margin of the left rectus muscle half way between the umbilicus and the costal arch A series of bismuth skiagraphs demonstrated an obstruction at the splenic flexure

On November 16, 1911, the abdomen was opened by a five-inch longitudinal incision through the left rectus muscle from the costal margin downward The transverse colon was exposed and traced to the splenic flexure Just below the splenic flexure was brought into view a half inch wide band, encircling and constricting the intestine to such a degree that when a moderate angulation was added gas would not pass Further examination showed this constricting band to have been formed by an epiploic appendage, the tip of which had been carried over the intestine and become adherent to the mesocolon in such a manner as to constrict the intestine When this was divided and its ends reflected to either side the bowel at once ballooned out and all signs of obstruction disappeared Further exploration downward along the sigmoid flexure was negative In the right iliac fossa, which was explored by the hand introduced through the wound, pericolic bands could be felt, but since these had not given rise to any symptoms, it was not deemed wise at that time to expose the aged patient to the dangers of the more prolonged operative proceedings which would be demanded for exposing and dividing them Most notable, however, was the condition of

About five years ago he began to have attacks of epigastric pain which were relieved by eating. Since then he gives the characteristic history of gastric ulcer, with increasing loss of weight and inability to work.

Upon operation, a very large ulcer was found on the posterior wall of the stomach, extending to the lesser curvature. There was also one enlarged, hard gland at the greater curvature. On March 19, 1913, a resection of the pylorus and about one-half of the stomach was done, the jejunum being united to the stomach about three inches from the cardia.

The patient made a good recovery and was discharged on April 4, his one complaint at the time being that his stomach seemed to hold very little. A microscopic examination of the excised gland showed it to be adenocarcinoma, as did also the margins of the indurated ulcer.

This case, Dr. Brinsmade said, was offered as an addition to the many proofs that ulcers of the stomach might degenerate and become malignant.

The microphotograph shows distinctly the crater of the ulcer with destruction of mucous membrane. The right side of the picture shows carcinoma (Fig. 1).

DUODENAL ULCER POSTERIOR GASTRO-ENTEROSTOMY

DR. BRINSMADE presented a man, thirty-five years old, who had been under treatment for five years for dyspepsia, giving the usual history of such cases. Upon operation, a rather large ulcer of the duodenum was found. Dr. Brinsmade did an ordinary posterior gastro-enterostomy, without closure of the duodenum, and the patient made a perfect recovery. Since the operation, which was done on the first of January, 1912, he had enjoyed excellent health and had gained over thirty pounds in weight.

PYLORECTOMY FOR RECURRENT GASTRIC ULCER.

DR. BRINSMADE presented a woman, thirty-three years old, who gave a history of having spent several months in bed, suffering from severe gastric symptoms, *i.e.*, pain, vomiting, with blood both in the vomitus and in the stools, and emaciation. Upon operation, an indurated ulcer, about the size of a silver dollar, was found on the anterior wall of the stomach. The appendix was found to be the seat of a chronic inflammation, and was removed.

The gastric ulcer was treated by inversion, thus cutting off its blood supply, and the patient made a very good recovery

Following this operation, which was done in January, 1911, the patient gained 27 pounds in weight and returned to her vocation, which was that of a teacher. Soon afterwards, she again began to lose weight, and by the following January her gastric symptoms were as severe as they had been prior to the operation. Accordingly, on June 12, 1912, the stomach was again exposed, and a large indurated ulcer was found over the site where the original flat ulcer had been turned in.

A pylorectomy was done, with a wide margin, and a gastro-enterostomy completed the operation, from which the patient again made a good recovery. Last winter she again suffered from vomiting, but upon giving up her work the gastric symptoms gradually improved, she had gained seventeen pounds in weight and was now in excellent condition.

This case, the speaker said, was shown as an example of how a flat ulcer might become converted into an indurated ulcer in the course of one year.

Dr. Brinsmade also exhibited two X-ray plates of a case where he did a gastro-enterostomy fifteen months ago. The first picture was taken within five minutes of the bismuth meal and showed most of the meal in jejunum. The second picture was taken twenty minutes later and showed very active peristalsis. As shown by plates, the stoma in this case was patent. The patient's symptoms had not been much relieved by the operation, and the plates show the reason. This patient, however, has never been willing to act on advice in regard to eating and drinking and it is difficult to determine accurately whether the large patent stoma is the cause of his present discomfort or not.

POSTERIOR GASTRO-ENTEROSTOMY AND ENTERO-ENTEROSTOMY FOR DUODENAL ULCER WITH THE ELASTIC LIGATURE. CONDITION AFTER TEN YEARS

DR. WILLY MEYER presented a male patient, seventy years old, who first came under his observation ten years ago with the history that eighteen or twenty years before that time—now almost thirty years ago—he began to suffer from severe and repeated hemorrhages from the bowels. These had since recurred intermittently, and had been especially severe during the previous

summer, while absent in Europe, so that when Dr Meyer first saw him, upon his return to this country, he was very feeble and had lost much weight

About that time, Dr Meyer said, he had done a number of gastro-enterostomies with McGraw's elastic ligature with very favorable results, and he thereupon determined to follow that method in this case During the early stage of the operation, the man had a sinking spell, from which he was revived with difficulty The operation consisted of a posterior gastro-enterostomy with a No 3 elastic ligature, long loop, and an additional entero-enterostomy, also made with the elastic ligature The patient made such a good recovery that two months later he felt equal to attending a banquet and partake freely of all kinds of food, and since that time he had remained in good health He was now a man of 70, weighing 190 pounds, which was a gain of 90 pounds since the date of the operation In spite of his apparent good health, however, as far as gastric symptoms were concerned, he had on at least three occasions had tarry stools, the last one a year ago, but without pain

PYLORIC EXCLUSION FOR DUODENAL ULCER POSTERIOR GASTRO-ENTEROSTOMY

DR MEYER presented a man, thirty-one years old, who came under his care during the past summer through the courtesy of, and after he had been under treatment by Dr Einhorn, who had made the diagnosis of ulcer of the duodenum The patient also gave vague symptoms pointing to the gall-bladder

On June 4, 1913, the abdomen was opened, and upon exposing first the appendix it was found to be much diseased and was removed The gall-bladder was then exposed and was found to be free from stones and normal in appearance After loosening the many firm adhesions, the pylorus was brought into view, and two ulcers of the duodenum were found, one near the pylorus, the other lower down They were inverted by suture and a posterior gastro-enterostomy was done The patient made a good recovery from the operation

ULCER OF THE STOMACH TREATED BY DOUBLE LIGATURE

DR JOHN ROGERS presented a man, fifty-nine years old, who for 30 years had suffered from sour eructations, with gastric pain

and discomfort, from which he found relief by the use of bicarbonate of soda. An examination of the stomach secretions, made in March, 1913, showed a total acidity of 74, with free hydrochloric acid, 41, and manifest traces of blood.

Upon operation, which was done on March 29, an ulcer was found posteriorly at the upper end of the lesser curvature, its location being such that excision would prove extremely difficult. Dr. Rogers thereupon ligated the gastric artery close to the celiac axis, applying a double ligature with the object of interrupting that part of the sympathetic nerve supply which accompanies the artery. The wound was then closed completely, nothing else being done. The patient made a good recovery, he was now entirely free from gastric distress and was able to eat anything. The total acidity had been reduced from 74 to 27, and the free hydrochloric acid from 41 to 20, no traces of blood. This was the result of an examination of the gastric secretions last April, and the last examination, made a few days ago, gave practically the same figures. The patient had gained steadily in health and strength and said he was now able to enjoy food from which he had been obliged to abstain since he was a boy. There are at present no symptoms and the patient considers himself entirely well.

DR. ROBERT T. MORRIS said he wished to speak of the advisability of inversion in the treatment of certain cases of ulcer. He had resorted to this method several times, both as a matter of choice and expediency, with very gratifying results. In one of his more recent cases the patient had first been operated on by Roux, who did his typical operation, and a year later he was again operated on by Dr. Cullen, of Johns Hopkins, who excised the pylorus. Subsequently, when Dr. Morris opened the abdomen, he found an ulcer situated at the margin of the jejunal opening. The condition of the patient was such that an excision was deemed inadvisable, and he simply inverted the ulcer, using Pagenstecher thread. In that case, the patient died a year later from another ulcer in the jejunum, and at the necropsy it was found that the previous ulcer that had been inverted, although still present, was not an active factor.

DR. ROGERS, speaking of the X-ray plates shown by Dr. Brinsmade, said it was formerly held that a large stoma was the safe thing to do in these cases, but as a matter of fact the gastro-

enterostomy opening could not completely close, and so far as he knew, it never did completely close. By leaving such a large stoma as was done in this case, it permitted the too rapid passage of the gastric contents before their proper digestion had occurred. The stoma should not be larger than the natural pyloric opening. The object of an artificial opening in cases of ulcer was to neutralize the gastric contents by a reflux of the duodenal contents, and if the opening was made too large, it immediately predisposed the patient to the formation of an intestinal ulcer by the too rapid discharge of the acid gastric contents.

DR LILIENTHAL said that while he had never personally seen a stoma of this kind close, he saw a specimen demonstrated by Dr Finney, of Baltimore, in a case in which a gastro-enterostomy had been done with the Murphy button. In that case, the opening that remained was barely large enough to permit the passage of a bristle. However, the speaker said he was convinced that the ordinary stoma made by suture was not very apt to close. Whether the trauma following the use of the button predisposed to such closure or not he did not know. Certainly in Dr. Finney's case the stoma had practically closed.

Speaking of the size of the opening, Dr Lilienthal said that last summer he had an unfortunate experience where he thought that the fatal outcome was due to the fact that the stoma was too large. The patient developed a vicious circle and was not benefited by a subsequent operation. In a more recent case in which he operated he was very careful to avoid this error, making the opening just large enough to admit the tips of two fingers.

Dr Lilienthal said that on previous occasions he had emphasized his opinion that pylorotomy should be done in two stages, especially if the patient was in a weakened condition. During the first stage (gastro-enterostomy) the operator could determine exactly what would have to be done, and at the end of two weeks, or perhaps three, the patient would be in a much safer condition for the second stage of the operation—the actual pylorotomy. To complete the operation at a single sitting occupied too much time, the shock was oftentimes too great, while an added disadvantage was that we often had to operate on tissues that were inflamed and, perhaps, with a perigastritis present.

DR MCWILLIAMS said that in a recent issue of *Surgery, Obstetrics and Gynecology* there was an article in which an author

attempted to refute the results of Cannon and Blake's experiments on dogs in connection with pylorectomy. Six cases of gastro-enterostomy were reported, in four of which it was shown that the gastro-enterostomy opening was patent, while in two of them the bismuth test showed that it passed through both openings. This author stated that proper drainage in gastro-enterostomy was secured by making the opening at the lowest portion of the stomach, and he maintained that Cannon and Blake's observations were erroneous when they said that a gastro-enterostomy did not afford drainage.

DR GREEN said he took it for granted that the two-stage operation advised by Dr Lilienthal did not apply to cases of acute perforating ulcer. The speaker said that during the last fifteen months he had seen four cases of acute perforating ulcer of the duodenum and one case of perforating gastric ulcer. In every one he did a posterior gastro-enterostomy after folding in the ulcer. All his cases recovered with the exception of one, where the perforation had taken place 27 hours before the patient came to the operating table.

DR WILLY MEYER said that he also believed in the inversion of ulcers, and had done it wherever possible. In that connection he desired to call attention to a recent paper by Seidel, of Dresden, in which he showed that even in very badly infiltrated ulcers, by placing the sutures properly, the ulcer could be covered.

As to peptic ulcers, the speaker said he felt assured that the too rapid exit of the gastric contents into the duodenum would in a number of cases be the exciting cause of such ulcers. We should not place the gastro-enterostomy opening too close to the cardia, rather closer to the pylorus, and it should not be too large. In these cases he usually advised his patients to drink large quantities of a solution of bicarbonate of soda.

On the other hand, we should not make the opening too small. Personally, he had never seen such a stoma close if made with sutures, but he had seen it close after the use of the Murphy button, and others had reported a similar occurrence if the pylorus remained patent. In dealing with duodenal ulcers, he thought we should exclude the pylorus. The most radical method for this purpose was that of von Eiselsberg, transverse division of the stomach in front of the pylorus with stoma of either end. In this connection he would again call attention to the value of

the wire-stitching instrument of Hueltl as a rapid means of performing this operation. One method that had been suggested for effecting the exclusion of the pylorus was to strongly tie off the stomach very close to the pylorus with a silk thread, which of course would perforate later on, and place in the groove covering the thread a twisted cord-like piece of omentum, which was tightly wrapped around it, producing the exclusion by autoplasty, as we might term it. Dr. Charles Mayo had used the omentum minor for this purpose. Whatever the means adopted, the speaker thought that with the patient's permanent recovery in mind, exclusion of the pylorus after duodenal ulcer was important.

DR. A. V. S. LAMBERT reported a case where the patient, after a long-standing history of gastric disturbance, with pain and hemorrhage, had a gastro-enterostomy done in some western city. This benefited him for a year. He was a man of rather alcoholic tendencies, and a year after the operation he had a sudden attack of syncope, followed by tarry stools. This was followed for a month by bleeding, anæmia, and gastric pain, in spite of medical treatment. An X-ray was taken, which revealed a condition very similar to that shown in the plates demonstrated by Dr. Brinsmade. The X-ray also showed that some bismuth remained in the stomach as long as two hours after a test meal, and that the stoma though large was placed too far from the pylorus.

The patient stated that the original operation was for an indurated duodenal ulcer, and a year later, when the abdomen was opened, it was found that there was a jejunal ulcer alongside of a large stoma, several inches from the pylorus. They thereupon did a Finney operation on the pylorus, and the original gastro-enterostomy opening was left alone. That operation was done six months ago, and the patient had since remained free from hemorrhage and other symptoms. Repeated X-ray plates had shown that the stomach contents now passed almost exclusively through the pylorus, very little passing through the gastro-enterostomy stoma.

DR. KAMMERER, the president, said he had done von Eiselsberg's operation of exclusion five times in the last two years for duodenal ulcers. One case, which was operated on about three months ago, was a man of thirty in whom the speaker, on operation, found a large mass involving the pylorus and the beginning

of the duodenum, evidently an inflammatory deposit about a chronic ulcer. Several months prior to the operation the man had had a severe hemorrhage, and this was followed by another, equally severe, two months after the ulcer had been excluded. There were a few other similar cases on record.

His other cases, Dr Kammerer said, had done exceedingly well. In some the operation dated back two years, and the patients had remained perfectly well, without any recurrence of their symptoms.

Dr Kammerer said he could not entirely agree with Dr Lilienthal that the two-stage operation was indicated in malignant tumor of the stomach. Personally, he had not been very fortunate in attempting to remove a malignant growth after doing a primary gastro-enterostomy, as he found, upon reopening the abdomen, that the tumor had become less movable than it was at the first operation. On one occasion he had been compelled to do a primary gastro-enterostomy and resect the pylorus afterward, owing to the extremely weak condition of his patient, but whenever possible he thought that the complete operation should be done at one sitting.

Dr BRINSMADE said that while on the subject of the inversion of gastric ulcers, he wished to call attention to the fact that the method was not always entirely satisfactory, as demonstrated by one of the cases he had shown at this meeting.

Speaking of the X-ray plates he had exhibited, Dr Brinsmade said they were shown as evidence of an unsuccessful case, and were intended to illustrate the very point brought up by Dr Rogers. The stoma was too large. It was made at the most dependent part of the stomach, and the plates showed its condition fifteen months after operation.

Dr LILIENTHAL said that what he had urged was not two operations, but a single operation in two stages, with an interim of perhaps two weeks between them. During the first stage he used no gauze, then there were no adhesions and the second stage was comparatively easy.

TUMOR OF THE CAROTID BODY

Dr HOWARD LILIENTHAL presented a woman, sixty years old, who was first shown by him at a meeting of this Society in the spring of 1909. At that time she gave the history of having had

a small tumor in the side of the neck for thirty years. During the preceding five years it had increased considerably in size, and during the last year it had grown so rapidly that she became alarmed. The case was diagnosed as one of tumor of the carotid body, the diagnosis being based on the hardness of the growth, its location, the long history and the fact that the speaker had seen and operated upon a similar case some years before. That patient died about two years after the operation of a relapse, with cachexia, but with no evidences of a secondary or metastatic growth. The histological diagnosis in that case, as in the present one, was made in the laboratory of the Mt. Sinai Hospital.

The tumor in the present case was about the size of a hen's egg at the time of the first operation. It was firmly adherent to the internal jugular and to the carotid artery, so that it was necessary to ligate both of these vessels close to the clavicle, and employing them and the freed tumor as tractors, it was possible to shell out the pneumogastric nerve and ligate the external and internal carotid arteries and also the jugular vein in their upper portions, thus completely resecting them. On the day after the operation there was aphasia and well marked right hemiplegia. The left eyeball was soft, and its pupil contracted. In the course of a few days all of these symptoms excepting the contracted pupil had disappeared. The pupillary contraction was probably due to injury of the superior cervical sympathetic ganglion. The aphasia was central. There was no aphonia. In a case reported by Dr. John Chalmers DaCosta before the Philadelphia Academy of Surgery, on May 7, 1906, the diagnosis had also been made prior to operation. DaCosta, too, had been forced to resect the carotid and the deep jugular, and he described the operation as a very dangerous one. His patient was a man fifty-three years old, and after the operation, although there was no aphasia, the tumor being on the right side of the neck, there was hemiplegia, which was very slow to disappear. The carotid body, according to DaCosta, was first described by Mayer in 1833, though its existence was suspected by Haller, and Luschka, in the early sixties, made studies of the gland. It was not invariably present. It was a small gland, varying in size from that of a grain of rice to a grain of corn, and was intimately connected with the carotid at its bifurcation. It did not resemble a gland in structure, and contained many blood-vessels.

Histologically, tumors of the carotid body were similar to the endothelioma or perithelioma of the suprarenal. DaCosta stated that the apparent pulsation in these tumors was transmitted from the arteries. In the case shown, however, it appeared that the tumor itself undoubtedly pulsated. Dr. Lilienthal said he considered the case inoperable, and the patient now showed signs of cachexia. For the past three or four months she had been receiving frequent injections of absolute alcohol into the tumor, but without appreciable effect. Possibly, electrolytic puncture might help.

Dr. Lilienthal said that malignant tumors of this type, including the hypernephromas, appeared to him to strengthen the germ theory of ordinary cancer and sarcoma, the tumors under discussion being perhaps always congenital and remaining merely locally malignant unless actual transplantation should occur through the invasion of a blood-vessel. True metastases through lymph vessels and spaces, as observed in the usual malignant growths, was more likely to be the mode of extension of known bacterial infections.

DR. MORRIS said that endothelioma gave a rather ready response to radium and the X-ray. In one case where he did a gastro-enterostomy to relieve the obstruction caused by a tumor of the pylorus, a section of the growth was taken, which showed it to be an endothelioma. The patient was subsequently X-rayed by Dr. Aspinwall Judd, and under the influence of the rays the tumor disappeared. Whether there was a later recurrence or not Dr. Morris was unable to say, as the patient was lost sight of.

GASTRIC NEUROSIS, WITH X-RAY FINDINGS SIMULATING CARCINOMA

DR. OTTO G. T. KILIANI showed a number of X-ray plates which had led to the mistaken diagnosis of carcinoma of the stomach. The case was that of a woman, twenty-three years old, who gave a history of gastric disturbance dating back four years, the symptoms consisting of discomfort after eating, nausea, headache, and vertigo. Chemical analysis of the gastric contents showed nothing definite. The case was looked upon as one of gastric neurosis, but as a precautionary measure, a series of radiographs were taken, and in these the contour of the stomach had the typical appearance of a carcinoma of the larger curvature.

at our hands, when there was found to be present a double-barrelled shotgun arrangement of the colon, the elements of which were bound together by a membranous envelope to which were added strong lateral bands confining the mass to the lateral parietes

CASE V—A lady thirty-two years of age, who, when she was twenty-eight years of age, first began to suffer from pain in the right iliac fossa. After a year of suffering her appendix was removed and she made a good operative recovery. Nevertheless her right-sided pains continued. In this case at operation the cæcum and ileum were found to be bound together, and the ascending colon to be constricted by distinct bands which were parts of a general membranous film covering in the ascending colon.

CASE VI—A woman fifty-one years of age, who had long been an ailing neurasthenic woman. It had been recognized that she was suffering from certain positive pelvic conditions, but after these were corrected by proper measures she continued to ail. Her appendix had not been removed. It was found, however, when exposed at operation to be the seat of a long-standing chronic inflammatory process, associated with membranous bands, which not only bound it to the cæcum and adjacent ileum but were also continuous as membranous films which bound together the ascending and first portion of the transverse colon as two barrels of a double-barrelled shotgun (cf. Case IV).

These cases constituted the sum of our experience up to October, 1911. In the period of time which has since elapsed the number of these special cases has considerably increased, partly, perhaps, because we are looking for them and have learned to recognize them. The number, however, is not yet so great but that the recital and analysis of individual cases is still important. Up to the end of the present hospital year terminating March 31, 1913, these additional cases number nineteen in all. The following is a somewhat full abstract of their several histories and the pathological findings.

CASE VII—*Right-sided pericolic bands not causing symptoms, constriction of colon distal to splenic flexure by band formed by adherent epiploic appendage* (Hospital No. 233)

Influenced by these findings, the stomach was exposed and carefully examined, and was found to be perfectly normal

Dr. Kiliani said the only explanation he had to offer for the Roentgen findings which both by himself and by a skilled radiographer were regarded as typical of carcinoma of the stomach, was that this patient was suffering from a gastric neurosis with the production of a large amount of mucus, which prevented the bismuth from coming in contact with the edge of the curvature, and gave a deceptive gastric outline

DR ARTHUR L FISK said that the case reported by Dr Kiliani demonstrated the necessity of not giving too great weight to any one sign but that all the symptoms considered together should determine the probable condition

Tumors when present are generally palpable and obstructive, and food remnants are found in the stomach, if the growth is cancerous there is diminished total acidity, also the free hydrochloric acid is less

If the symptoms do not correspond with the X-ray findings, the accuracy of these should be questioned

A logical and judicial consideration of the signs and the symptoms should result in accurate diagnosis

TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY.

Stated meeting, held October 6, 1913

DR G G DAVIS, President, in the Chair

BONE GRAFTING FOR POTT'S DISEASE

DR WALTER G ELMER called attention to the operation of bone grafting for Pott's disease. He said that great credit is due to the originator of this operation, who utilized the spinous processes of the vertebræ as bone grafts from which a firm bridge of new bone was built up, spanning the area of disease and holding the spine rigid. In doing this, the spinous processes are denuded of their periosteum, cut off at their bases and placed like the links of a chain along the tops of the arches. A subsequent operation was suggested which leaves the spinous processes intact, a bone graft from the tibia being inserted in their tips which are split to receive it.

Tuberculosis of the body of a vertebra is a disease which, if untreated, progresses toward destruction of the vertebral body. Even when proper treatment is instituted the disease progresses beyond that time—gradually losing its activity until finally arrested, then the process of repair begins. It may be likened to a ball rolling down an inclined plane—gathering momentum as it descends—and then out onto a level surface, when the momentum is gradually lost and its motion is finally arrested, so with the disease. The level surface is reached at the moment the child's spine is put at rest, but the disease continues to progress to a point considerably beyond this.

An operation therefore which immobilizes the spine and actually adds to its natural strength would appear to be a wise surgical procedure. The new bone which is formed spreads out in a broad compact mass upon the transverse processes and unites the spinous processes.

The new bone grows but if it does not keep pace with the

natural healthy bone of the spine it must exert a corrective influence upon the developing kyphosis

An operation of this character, requiring, perhaps, forty minutes to perform, and not always upon the most favorable class of patients, must have a mortality. Just what the mortality is cannot be stated. If it should prove to be greater than one per cent it would make one hesitate to recommend the operation. The operation, however, shortens the treatment and hastens the cure, and must save certain patients that would otherwise progress unfavorably.

A considerable number of patients have now been operated upon in the Orthopædic Department of the University of Pennsylvania—both operations have been employed—every region of the spine has been operated upon—the patients have been children and adults, chiefly children, of course—and in every instance the patients, apparently, have been distinctly benefited.

A support is usually worn for six months after the operation. During the latter part of this period the plaster jacket is discarded and a simple back board of plaster held in place with adhesive straps, or some similar appliance is used.

Dr Elmer presented two children who had been treated in the Orthopædic Department of the University of Pennsylvania and through the courtesy of Dr G G Davis were now shown.

CASE I—A boy who had developed a slight kyphosis in the upper lumbar region when brought to the hospital nearly two years ago. He is one of the early cases operated upon. Now a broad compact mass of bone spreads far out on the transverse processes. All other parts of the spine are freely mobile and it flexes readily as he stoops to pick up an object. He walks naturally and is in perfect health so far as one can tell and has been cured for about a year and a half.

CASE II—A little girl, one of the more recent cases, in which case the feature worth mentioning is the improved line of the spine. No kyphosis can now be seen. Tracings which were made with the lead strip when she was being treated with plaster jackets show quite a little kyphosis in the lower dorsal region—a comparison of those with a tracing made a short time ago shows the difference—this last one shows no kyphosis. The child is strong and healthy and growing, and it is not unlikely that the spine in growing is becoming straighter. She has worn no sup-

port for about two months Both these children had the bone graft taken from the leg

TUBERCULOSIS OF KNEE

DR ELMER presented a little girl to illustrate the favorable outcome of what promised to be a very discouraging case Four years ago she was injured and was treated by her physician for tuberculosis of the knee About eight months later she was admitted to the Jewish Hospital There was then a discharging sinus above the outer condyle of the femur A tubercular osteomyelitis involved the epiphysis and lower portion of the diaphysis The bone was opened on the side and the diseased part cut away and curetted out—leaving a shell of bone She was treated in bed for three weeks—then sent home wearing a fenestrated plaster cast, high shoe and crutches She was injured later on by one of her playmates, and the disease then invaded the knee-joint which became distended with tubercular pus She was re-admitted to the hospital, the joint opened on both sides and drained, and then followed a long course of treatment

She was kept on crutches and in plaster for one year, then a Thomas knee-brace, then plaster of Paris and the child walking on the limb

The sinus closed last January She has worn no support for eight months She now walks quite naturally and with free and normal motion in the knee-joint and appears to be in the best of health

DR GWILYM G DAVIS queried as to whether the results in cases of bone grafting for tuberculosis of the spine will be permanent He had recently seen a skiagraph of a case which had been done over a year ago and it showed a distinct shadow of bone lengthwise in the position of the curve, whether this was the original or new bone he could not say, but at any rate there was bone there The question may be raised as to whether the fixation will remain The later history of cases, two or three years after the operation, should be known, as to the permanency of the union

BILATERAL TEMPOROMAXILLARY ANKYLOSIS

DR JOHN H JOPSON presented a woman, aged twenty, who applied for treatment at the Polyclinic Hospital for an ankylosis of the jaws which was of three years' duration It began as

an arthritis in the course of an illness of acute onset attended by inflammation of most of the joints, including the interphalangeal joints, ankles, knees and elbows. She was bedridden for several months, the polyarthritis lasted a year and a half, was attended by contractures of the arms and legs and finally ended in recovery, except for the persistent ankylosis of the jaws and the lumbar spine.

She has a bony thickening over the lumbar vertebræ with fixation in that region and at one time this locality was the site of considerable pain. She wore a spine-brace for a year but later discarded it. The only disability of which she now complains is the fixation of the jaw.

Examination showed practically complete ankylosis of both temporomaxillary joints with no lateral motion present, and only about one-eighth inch of motion upward and downward, which was practically due to springing of the bone. There was an interval of one-sixth inch between the incisors, the lower being a little behind the upper, and the molars were in contact. She could eat only by breaking or cutting her food into small particles and tucking it into her mouth with her fingers.

An attempt was first made to separate the jaws by means of wooden wedges under general anæsthesia, but nothing was accomplished. Three weeks later Lilienthal's operation was carried out on both sides. Ether anæsthesia, and the preliminary hypodermic administration of morphia to prevent vomiting, were used.

After turning down the zygoma, excellent exposure of the temporomaxillary joint was obtained on either side, and firm bony ankylosis was found to be present. The hammer and chisel were used to cut away the condyles and the neck of the bone. No unlocking of the jaws could be obtained until the second joint had been excised when free opening was permitted. A flap from the temporal fascia was turned back into the joint on each side and sutured between the bones, after which the resected portion of zygoma was replaced and held by periosteal suture.

The patient made a good recovery, although there was slight superficial infection on each side. She moved her jaws well after a few days, and was put on solid diet at the end of a week. It was not found necessary to keep anything between the teeth at any time. She ate an apple twelve days after operation by biting into it, and said she could have done so sooner. When discharged

from the hospital she had a possible separation of seven-eighths of an inch between the incisors, with a strong bite, and good rotary and grinding movement

Her general nutrition has rapidly improved. She has gained more than 20 pounds, and eats everything

The advantages of the method of approach in this operation as described by Lilienthal (*ANNALS OF SURGERY*, August, 1911) include a good and easy exposure of the joint and the absence of any danger of injury to the facial nerve

Dr Lilienthal has reported four cases, three of them operated upon with perfect success, and the fourth still under treatment

There is some risk of slight infection which may come from the traumatism of the operation, and possibly through the salivary duct and the parotid

The method consists of making an incision along the zygoma, beginning just in front of the auricle, carried down to the periosteum. At right angles from this, a second incision runs downward in front of the ear for a distance of an inch and a half and divides only the skin. The triangular flap so outlined is dissected downward and forward. The zygoma is divided by carrying a fine Gigli saw around it in two places, after which it is turned down with the masseter muscle and soft parts attached, including a portion of the parotid gland, and fibres of the facial nerves

When bony ankylosis exists the condyles and the neck on each side are removed with gouge and curette or with hammer and chisel. Arthroplasty is completed by turning in a flap of temporal fascia

It is usually advisable to operate on both sides at once when unilateral excision will not unlock the jaws, as a two stage operation doubles the danger from ether vomiting which is always present, and which might result fatally. Lilienthal recommends preliminary starvation and morphia half an hour before beginning the ether,—the preparation which proved successful in this case

UNUNITED FRACTURE OF THE NECK OF THE FEMUR

DR JOHN H JOPSON presented a colored man, aged fifty-one, who slipped and fell on a level floor, October, 1912. He was unable to stand or walk, was taken to a rural hospital where he remained

for five days, and was then brought to his home in Philadelphia. He received no treatment, but after several months presented himself at the Polyclinic Hospital, disabled and unable to walk without assistance. Examination showed an ununited fracture of the neck of the right femur, with a considerable amount of callus around the fracture and three-fourths of an inch shortening.

An open operation was performed through an anterior incision, the joint opened, a large amount of synovial fluid under tension evacuated, the fractured surfaces freshened and a $2\frac{1}{2}$ inch screw introduced through the great trochanter into the head of the bone.

Primary union was obtained. He now has what appears to be good bony union with an inch and a half shortening and a good functional result. He still uses one cane in walking, but is doing a little light work.

ILEOSIGMOIDOSTOMY (LANE)

DR JOHN H JOPSON presented a man, aged thirty-eight, who had suffered for 17 years with abdominal pain and constipation. Illness began rather acutely with what was diagnosed as inflammation of the bowels. Pain increased in severity and six years ago his appendix was removed. He was relieved for a time, relapsed again and in the Spring of 1912, Dr Jopson operated and found adhesions, perigastric, periduodenal, and generalized throughout the abdomen. Extensive division of adhesions was followed by temporary improvement lasting for eight months, when he again relapsed, and reapplied for treatment in June of 1913. He was obstinately constipated, complained of constant pain in the hypogastric region, and was unable to work at his trade as a paper-hanger.

He was again operated upon in the end of June. Marked perigastritis and pericolicitis were present. The small intestines were practically free of disease, their peritoneal coat being in striking contrast to that of the large bowel and stomach. The stomach was much distended.

An ileosigmoidostomy was made according to Lane's technic, except that the anastomosis was made as high in the sigmoid as possible. The colon was not removed. He remained in the hospital about four weeks. He returned to his work a month later greatly improved, and since then he has gained many pounds.

in weight The pains have disappeared and constipation has been much improved He usually has two or three liquid movements a day, sometimes finding it necessary to use a mild laxative He considers himself relieved of most of his old symptoms

THE RELATION OF POSTERIOR SUBLUXATION OF THE SHOULDER-JOINT TO OBSTETRICAL PALSY OF UPPER EXTREMITY

DR T TURNER THOMAS read a paper with the above title for which see the February issue of the ANNALS OF SURGERY

DR ASTLEY P C ASHHURST said that he had recently seen at the Episcopal Hospital a child of two years or thereabouts, who had been injured in birth, there was complete flaccid palsy of the upper extremity, and *complete loss of sensation* in the limb, and this had persisted unchanged since birth This child will chew its own fingers, frequently injuring them in this way, and sometimes burning or scalding them

Again he had recently operated, at the Episcopal Hospital, on a boy of twelve years who presented partial flaccid paralysis of the upper extremity due to injury at birth, the shoulder-joint was almost flail-like, and if his arm happened to get into the position of extension (behind the patient's body), the head of the humerus became subluxated anteriorly, caused him pain, and he had to pull this arm forward with the other hand There was also persisting paresis of the muscles supplied by the radial nerve There was no posterior subluxation of the head of the humerus

Another case was that of a baby with typical "obstetrical palsy" of the arm sent from Dr Harte's service in the Orthopædic Hospital to the nervous department for examination Dr Boyer found reactions of degeneration present, but on account of the extreme youth of the patient it was not possible to determine very accurately which muscles were at fault

Last winter he saw, at the Episcopal Hospital, two brothers (one about twelve years old, the other about seven years) who had been similarly injured in birth In both patients there was distinct posterior subluxation of the shoulder, and the head of the humerus could be felt back of the acromion Typical paralysis was present, but great improvement had occurred since birth

Last winter he saw at the Orthopædic Hospital a baby only a few weeks old, who had been injured in birth, by attempted but

unsuccessful version When born the arm was held across the front of the neck, with the elbow highly elevated, the forearm fully pronated, and the palm of the hand looking forward, and being in a position above the opposite shoulder The limb rebounded to this position when attempts were made to bring it down The head of the humerus was clearly palpable beneath the spine of the scapula, and in the axilla was a bony prominence, probably the glenoid or coracoid There was practically complete paralysis The mother was directed to manipulate the arm daily, and she brought the patient back for observation at frequent intervals at first The child is now nine months old Now the head of the humerus stays in the glenoid, and can be felt projecting forward in front of the acromion as is normal, it is not palpable beneath the spine Great improvement has occurred in the paralysis, and is continuing, only recently there has returned very slight power of extension of the wrist and fingers Otherwise there is complete paralysis of the musculospiral nerve

Dr Ashhurst remarked that it has been maintained by Duval and Quillain (*Arch Gén de Méd*, 1898) that there are no such clinical entities as paralyses due to lesions of the brachial plexus, only two types existing, radicular and terminal, affecting either the spinal motor roots or the nerve trunks below the plexus It appears to be the contention of Dr Thomas that nerve lesions of any kind are of extreme rarity, and if not altogether hypothetical at least are secondary in causation and importance to lesions of the shoulder-joint

The cases he had now cited seemed to him to demonstrate First, that pure nerve lesions occur (Cases I and II) and may be of much greater importance than any injury to the shoulder-joint even if this is present (Cases III and V), and second, that, as Dr Thomas has pointed out, posterior subluxation of the humerus is a frequent lesion, often overlooked and perhaps may be the cause of persistence of paralysis (Case IV).

There can be little doubt that surgeons who see many of these cases will have their interest stimulated in the pathogenesis and treatment of the lesions by this further very important contribution made by Dr Thomas to the surgery of the shoulder-joint.

DR THOMAS, in closing, said that he did not mean to say that none of these cases of birth palsy were due to rupture of the

will fill all branches of the sinuses. Radiograms taken of the injected region show in perfect clearness the extent and ramifications of the fistulous tracts, and often lead us to the focus of disease (Fig 1). A glance at such picture enables us to discriminate between operable and inoperable cases, whereas with the older diagnostic aids, such as the probe or the injection of colored fluids, the operation itself had to be performed in order to determine whether the case was operable or not.

This diagnostic method led to the discovery that the injection of the bismuth paste has a distinct therapeutic effect. This was not fully appreciated until a year later when we observed that the patients on whom we had employed the injection for diagnostic purposes returned to us after months entirely cured. This at once suggested the use of bismuth-vaseline paste for curative purposes, and our expectations were far surpassed when we tried it in a number of obstinate cases.

On January 15, 1908, I brought before the Chicago Medical Society the first fourteen cases treated by this method, ten of which were then cured. Of these fourteen cases, thirteen are now entirely healed, one died in 1910 after sixteen years, suffering with most extensive necrosis of the spinal column.

Soon after my first publication in the *Journal of the American Medical Association* and the *Centralblatt für Chirurgie*, surgeons in all parts of the world began to employ the bismuth paste. Their readiness to give it a trial was partly due to the simplicity of the method applicable to a class of cases for which there was no efficient remedy. Suitable cases for a trial were abundant everywhere, and only too willing to try anything new.

Reports soon began to find their way into literature. Some authors obtained results even better than ours, others were only partially successful, and then in the hands of a few the method was a failure. Considering, however, that 100 per cent of these cases in which it was tried had already been treated by other methods without success, we must regard

Male, seventy-five years of age Had been a hale, vigorous, and active man Four years ago he had an acute digestive disturbance accompanied with vomiting and purging Two years later he began to experience in the splenic region a vague sense of discomfort which has continued to the present time At irregular intervals there would be exacerbations of pain with an accumulation of flatus in the colon and constipation, culminating in a diarrhoeal attack after which relief would follow for an indefinite time

During the month immediately previous to coming under our care this condition of intestinal irregularity had been quite marked All his trouble subjectively was localized in the region of the splenic flexure The tendency to constipation was marked When cathartics were taken and these were effectual in moving the bowels, relief to his subjective symptoms followed for the time being. Abdominal palpation was negative with the exception that there was a fixed point of moderate tenderness on the outer margin of the left rectus muscle half way between the umbilicus and the costal arch A series of bismuth skiagraphs demonstrated an obstruction at the splenic flexure.

On November 16, 1911, the abdomen was opened by a five-inch longitudinal incision through the left rectus muscle from the costal margin downward The transverse colon was exposed and traced to the splenic flexure. Just below the splenic flexure was brought into view a half inch wide band, encircling and constricting the intestine to such a degree that when a moderate angulation was added gas would not pass Further examination showed this constricting band to have been formed by an epiploic appendage, the tip of which had been carried over the intestine and become adherent to the mesocolon in such a manner as to constrict the intestine When this was divided and its ends reflected to either side the bowel at once ballooned out and all signs of obstruction disappeared Further exploration downward along the sigmoid flexure was negative In the right iliac fossa, which was explored by the hand introduced through the wound, pericolic bands could be felt, but since these had not given rise to any symptoms, it was not deemed wise at that time to expose the aged patient to the dangers of the more prolonged operative proceedings which would be demanded for exposing and dividing them Most notable, however, was the condition of

FIG 1

Fig I



Network of sinuses originating from hip joint

Tuberculosis of seventh and eighth ribs Bismuth injected through sinus in sternum

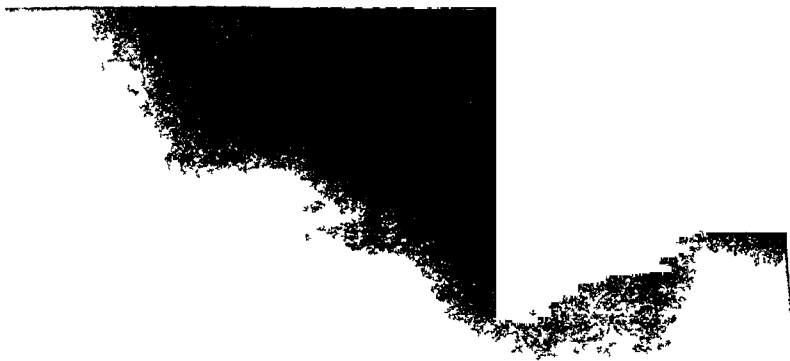


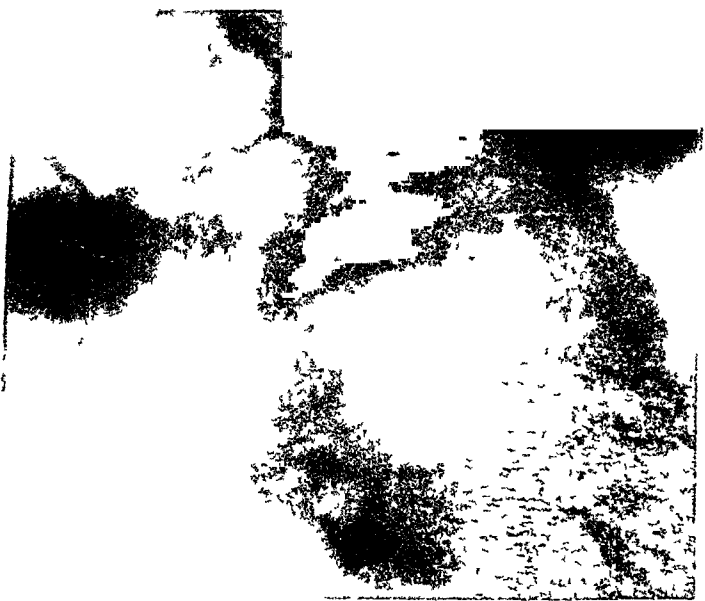
Fig. 11.
Tuberculosis
of
Ribs
Back



FIG



Resected ribs showing that disease existed within the cancellous tissue



SINUS PASSING THROUGH SPINAL COLUMN.
INJECTED WITH BISMUTH PASTE

Beck.

FIG 5

Fig V

Tocus in 12th
Vertebra

12285

2nd
SILVER

Supposed rectal fistula repeatedly operated causing the patient to be tuberculous of the chest and spine.

Hip joint disease sixteen years duration operated fifteen times without success Injection of paste in 1907 closure in thirty days No recurrence



FIG 7

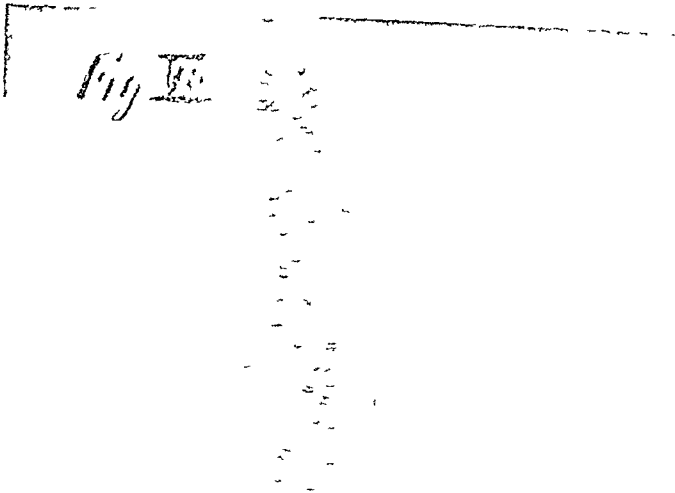


Fig 7

Network of Sinuses
of
TB of Tibia
Tumor Resected
18 Dec 1966



Complexity of sinuses of knee joint pro- nounced due to use of prosthesis

the peritoneal layer of the transverse colon from the point of constriction backward. Its surface was congested and was somewhat rough and granular in appearance, and at points presented a filmy deposit. To the mind of the observers the condition was strongly suggestive of the early stages of the formation of the more extensive well-developed, membranous films which had been demonstrated to be present on the right side. This reddened and granular condition of the peritoneum of the transverse colon was unquestionably a result secondary to the presence of the obstructing band near the splenic flexure. The adhesion of the tip of the epiploic appendage was itself an unmistakable evidence of the presence at a previous time in this locality of an acute infectious process.

Two years have now elapsed since this operation, and the patient has remained in vigorous health, free from his old obstructive symptoms.

CASE VIII — Posttyphoidal diffuse adhesive peritonitis, widespread intra-abdominal adhesions and pericolic films, chronic appendicitis, ileac kink, relief by separation of adhesions and removal of diseased appendix (Hospital No 240)

Male, thirty-seven years of age. A thick-set, neurotic man with tendency to obesity. Seven years ago had typhoid fever, which ran a course of seven weeks. Three years ago was confined for ten days by an attack, the chief element of which was pain referred to the right side of his abdomen. This gradually disappeared in its acuteness, but ever since that time he has had pain at irregular intervals referred to the same region. Four months ago he had an attack more aggravated than usual, which lasted for two weeks. His bowels are constipated, and whenever he is tired or has been exposed, he suffers from colicky pains in them. He also is subject to attacks of spasmodic pain referred to the pylorus. These attacks of pain are always preceded by a condition of constipation and are relieved when the bowels move. There is tenderness on pressure over the region of the appendix, which tenderness extends downward into the pelvis. There is some tenderness complained of over the pylorus.

Operation (December 7, 1911) — A four-inch oblique incision rather high in the right iliac region. When the abdominal wall had been divided no free peritoneal cavity was entered, but the subjacent intestines everywhere were found adherent to the parietal peritoneal surfaces. An entry, however, was effected between

even the smallest percentage of cures in this series as an actual gain. The accumulation of reports in the past five years from all sources indicates that more than 50 per cent. of these apparently hopeless cases were finally cured.

The uses of bismuth paste are threefold, namely:

- 1 For *diagnostic* purposes, by which I mean for making a correct anatomical diagnosis and tracing the sinus tract
- 2 For *therapeutic* purposes in chronic suppurations
3. For *prophylactic* purposes, which means for the prevention of sinuses.

FOR DIAGNOSTIC PURPOSES.

Its diagnostic value has been acknowledged by all who have employed it. There are recorded in literature from all parts of the world many hundreds of cases in which this method cleared up puzzling conditions. For illustration, I cite here a case which is now under my care.

P. S., forty-one years old, rheumatism at twenty-nine, malarial fever at thirty. Ten years ago he developed a pronounced pulmonary tuberculosis and went to Arizona and gradually recovered from the tuberculosis of his lungs. January, 1910, he noticed a small abscess on the left of his sternum. It was incised and the bone scraped several times. In August, 1911, I removed a part of the sternum to eliminate the focus of disease, but a foul discharge persisted. Another radical operation was performed six months later in Arizona, surgeon resected the greater part of his sternum and four inches of the sixth rib adjoining the sternum. Discharge increased and condition became much aggravated. He returned to Chicago, June, 1913. An injection of paste with the taking of a radiograph for anatomical diagnosis immediately disclosed the cause of failure. The seventh and eighth ribs, at the junction of the lower part of the sternum, were diseased. The radiogram plainly shows that the disease extended through the interior of the two ribs (Fig. 2). A resection of these two ribs proved conclusively the correctness of the diagnosis. The ribs appeared normal on their upper surface, but I was absolutely certain that the disease was located within the marrow of the ribs (Fig. 3), and therefore removed them.

After their removal the suppuration ceased and wounds closed by perfect healthy granulation

Examples like this explain why surgical operations for these chronic suppurating sinuses often fail. A glance at the radiograph which represents injected sinuses teaches us how irrational it is to attempt a dissection of a net-work of sinuses which lead into an inaccessible region. In the light of these pictures the probing of a sinus will not appeal to those who wish to be consistent (see Fig 4)

I have previously cited a large series of cases in which incorrect diagnosis of the sinus led to useless and even dangerous surgery, in which, aside from the therapeutic results, the paste cleared up the cause of failure (I cite here only one typical example)

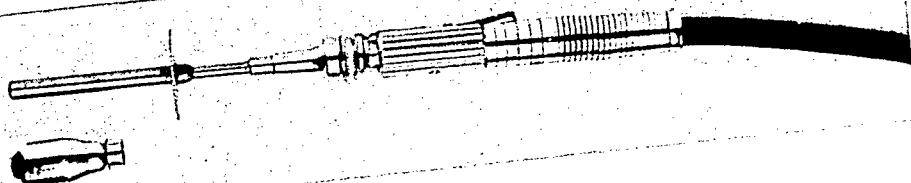
Supposed rectal fistula, repeatedly operated causing incontinence, disclosed to be tuberculosis of the eleventh dorsal vertebra

A H, fifty years old, was first seen by me in June, 1913. He stated that four years before he had been treated for pararectal abscess, after he had suffered for nearly eight years with what was thought to be rheumatism of the back. The operation resulted in a fistula, fever and emaciation began from that time. He was confined to his bed nearly all the time. A second and third operation was performed with division of the sphincter resulting in complete incontinence of the rectum. Another operation was then performed above the crest of the ileum and two more sinuses remained. I saw him in June, 1913, at his home in Canada. He was unable to walk, having been confined to bed for the last fourteen months. July 12, 1913, he was brought to Chicago. The injection of paste as shown in Fig 5 revealed the true diagnosis. The sinuses with several side tracks reached from the rectum directly into the eleventh and twelfth dorsal vertebræ, where the disease originated. The injection not only cleared up the diagnosis but had a marked therapeutic effect. The rectal sinus closed, and the man gained twenty pounds in six weeks, and was able to walk about five miles each day. He is now engaged in his usual work, but the two sinuses at the crest of the ilium still discharge small quantities of pus.

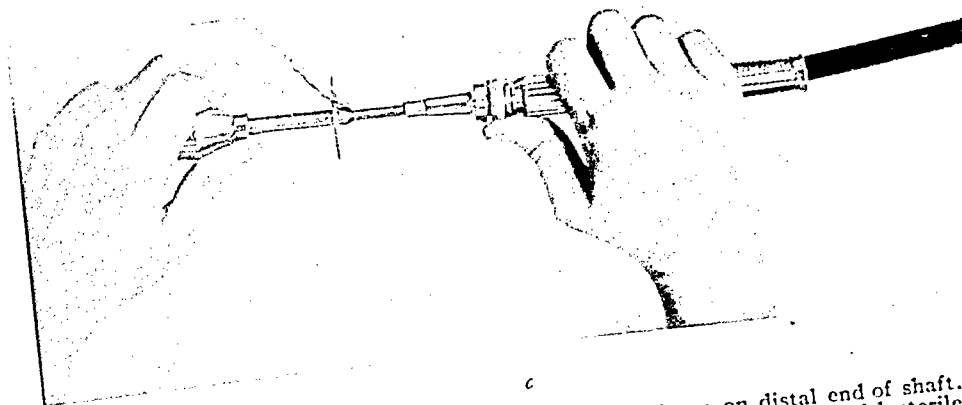
FIG. 2.



a



b



c

a, type of circular saw used. Note removable metal cap on distal end of shaft. In using the saw, the tip of the shaft which fits into this cap should be greased with sterile vaseline to prevent it becoming too hot to hold. All the metal can be dry sterilized. The flexible shaft is wrapped with a sterile bandage. b shows metal cap removed. c shows method of holding saw, which gives the operator easy control.

Name	Number of cases	Percentage of cures
Ochsner, Chicago	20, tubercular sinus	55
Ridlon and Blanchard	17, tubercular sinus	53
Beck, E G, Chicago	192, collective report	64
Robitecksh, Minneapolis	9, tubercular sinus	55
Don, Edinburgh	6, tubercular sinus	17
Rosenbach, Berlin	4, tubercular sinus	50
Dollinger, Budapest	16, tubercular sinus	12½
Beck, J C, Chicago	319, accessory sinuses	22
Pennington, Chicago	17, rectal fistulæ	76
Baer, Baltimore	12, tubercular sinus	33½
Stern, Cleveland	4, tubercular sinus	100
Steinman, Muenchen	5, tubercular sinus	20
Bogardus, U S A	1, tubercular sinus	100
Vidakovich, Russia	2, empyema	100
Nemanoff, St Petersburg	6, empyema	100
Ochsner, A J, Chicago	14, empyema	85
Beck, E G, Chicago	11, empyema	82
Ely, New York	14, tubercular sinus	43
Hines, Cincinnati	9, tubercular sinus	89
Cuthbertson, Chicago	1, intestinal fistula	100
Sandoe, Sag, Budapest	2, otologu	100
Hertz, Boyer, Morens, Paris	11, renal sinuses	73
Zollings, Zurich	25, tubercular sinus	54
Schober, Philadelphia	5, tubercular sinus	80
Gessner, New Orleans	4, tubercular sinus	50
Schmid, Vienna	15, tubercular sinus	30
Rivero, Porto Rico	8, tubercular sinus	75
Goror, E, Paris	2, tubercular empyema	66
Reichelfelder, Washington	4, tubercular empyema	75
Brandes, Kiel	29, all varieties of sinuses	76
Beck, R, Chicago	58, alveolar sinuses	54
Beck, R, Chicago	9, empyema antrum	66
Collective reports from 19 dental surgeons in U S A	39, alveolar sinuses	74
Collective reports from 19 dental surgeons in U S A	4, empyema antrum	100

It must be taken into account that this represents a class of cases in which other treatment had previously been applied and had failed, some cases had even passed through a series of as many as twenty unsuccessful surgical operations, often the disease having lasted many years, yes, as many as forty years, as occurred in two of my cases

An example or two may serve as an illustration of the therapeutic possibilities

Hip-joint disease of sixteen years' duration Fifteen operations Injection of paste Closure in thirty days

Miss M G, aged twenty-one, developed a painful condition

of her right knee and hip at the age of six. For one year she was treated symptomatically, and then a diagnosis of hip-joint disease was made by aspiration of pus from the hip. Incision and drainage (at the time considered the proper procedure) made Condition was thus aggravated, and after six months of extreme suffering, often requiring chloroformization during dressings, a radical operation was performed, consisting in the resection of the head of the femur. This radical procedure, however, resulted in the formation of many sinuses and the persistence of fever. During the following ten years she submitted to thirteen more or less radical operations, at intervals of from six months to three years, all of which, however, were of no avail. The discharge and pain persisted. The last operation was performed by Professor Senn, in June, 1907. It was the most radical procedure thus far undertaken. Both trochanters were removed, and the acetabulum was thoroughly curetted. The five sinuses, however, kept on discharging pus. In December, 1907, the first injection of bismuth paste was made, and repeated every two or three days, and on January 15, 1908, the sinuses were closed and have remained thus for 6 years. The radiograph (Fig 6) shows the extreme destruction of the joint, the end of the femur, including both trochanters, having been removed. The rim of the acetabulum is filled with bismuth paste, showing distinctly a collateral sinus.

Causes of Failure —To explain the varying results among different authors, many factors must be considered. During my visits to various hospitals and clinics in America and Europe, I have had some opportunity to observe why some men have failed to obtain the best results and I shall enumerate the causes which I believe are responsible for the failures.

We must bear in mind that a sinus or fistula is nothing more than a shrivelled abscess or abscesses. No sinus originates by burrowing its channel from one end to another. The focus of the disease is often at a considerable distance from the opening or openings of the sinus. It is, therefore, inconsistent to try to eradicate the suppuration by only dissecting the sinus tracts. With the radiographic reproductions of the

labyrinths of sinuses before us, an attempt to dissect the same borders on the ridiculous (Fig 7)

To strike at the root of the trouble is the only rational method to pursue Find the focus from which the sinus originated, eradicate this focus and in practically all instances it will heal spontaneously.

It is, therefore, essential that when a fistula or sinus is injected with bismuth paste, the paste must reach the focus of the disease If through faulty technic this is not done, one cannot expect results It is likewise essential that all branches and crevices of the sinuses of the tract should be completely filled at one time If one misses a part of the tract, the sinuses will continue to suppurate

My brother Carl and I have treated a large number of cases in which the bismuth paste had been applied by others without success This gave us the opportunity to study the causes of failure in a variety of most instructive cases In some of these, the cause of failure could not be explained The sinuses often healed after our first injection, whereas the same patient had received many injections previously with no result We could not tell whether faulty technic, unsuitable instruments or improper material had been employed

In other cases the causes of failure were easily discovered Aside from the most common cause, namely, the sequestrum, we found foreign bodies, such as in one case a metal probe in the humerus, in another a rubber tubing within the medullary canal of the humerus, accidentally left in years before, then two rubber tubes within an old drained empyema cavity, etc These were causes which had prevented the paste from obliterating the suppuration As soon as these foreign bodies were removed, the cure was almost spontaneous

These are, however, less common occurrences They do not account for any considerable percentage of failures From observation, I conclude that the most common cause is the faulty technic and insufficient knowledge of the rules which have been laid down for the treatment I have been asked innumerable times "How often do you inject?" The

proper answer to this question would be: As often as you have failed to reach the focus of the disease.

The first injection should produce the desired result. If it does not, then we must assume that the paste has not found its way into all portions of the diseased tract, and we must try it again. It is a safe rule to wait at least one week. If the discharge changes its character from purulent into a serous, and the microscopic examination of a slide and culture shows that the secretion is sterile, we should *not reinject*, since the sinus will heal out within a very short period. If, however, the discharge continues to be purulent, and we continue to find microorganisms in it, then we should reinject at least two times a week. If there is no change within a reasonable length of time, then we should search for other causes of failure.

Only six per cent. of all the cases in our series have finally been given up as hopeless. For obvious reasons we are not to be envied for the class of cases which fall into our hands for this treatment. They constitute the worst scum of surgical refuse, cases in which every sect of medicine, surgery and quackery had had a chance, and after all had failed to cure the sinuses then someone tried the bismuth paste. If this cured the case, all was well, but if it did not, then the case came to us. Nevertheless, out of this apparently hopeless material I am now able to exhibit many most satisfactory results. It is a mistake in giving a method only a superficial trial, to lose patience and subject the patient prematurely to another useless operation. Experience teaches us that operative treatment of this class of cases is highly unsatisfactory, if it were satisfactory, we would not have armies of invalids, with suppurating sinuses, going around from clinic to clinic some for as many as twenty years.

Surgeons all over the world are on the alert and would not permit such unfortunate people to linger in such condition if they knew of a surgical method for its eradication.

FOR PROPHYLACTIC PURPOSES

By this is meant the prevention of sinuses. We know that the sinuses are the sequelæ of pre-existing abscesses, and therefore, we must begin by treating the abscess in order to prevent the sinus. This procedure consists in the opening of cold abscesses and injecting them at once with a *ten per cent* bismuth paste, without suturing the opening or introducing a drain. The quantity used depends upon the size of the abscess, but should not exceed 100 grammes, because in these fresh abscess walls, absorption of bismuth is apt to take place more rapidly, and cause bismuth poisoning. The injection acts as a modifying substance, similar to that of iodoform emulsion, and prevents secondary infection. In a series of over 100 cases, in which I have employed it, only one developed a severe secondary infection, and only four resulted in sinuses (No deaths). Follins' figures show that 50 years ago, 56 per cent to 60 per cent of all psoas abscesses operated upon died from secondary infection. This method is described in detail in the *Revue de Chirurgie*, T. xlii, December 10, 1910.

We have treated with this method 110 cases, and have made the following observation:

(a) That in practically all cases we could prevent a secondary infection.

(b) That the creamy pus upon opening the cold abscess was changed into a straw-colored clear fluid within three or four days after injection.

(c) That 90 per cent of all cases closed within three weeks after incision and injection.

The preference to the bismuth over other modifying substances was given for the following reasons:

1 The paste is injected through a small incision instead of using a trocar, and thus the possibility of missing the abscess is eliminated.

2 By discarding the aspirating needle the danger of

injuring underlying vital organs or entering blood-vessels is avoided.

3. Through an incision it is possible to evacuate the larger clumps of the tuberculous débris, which could not pass through the aspirating needle

4 The thick paste within the cavity will allow the escape of secretions along the walls of the abscess, but will not permit the entrance of infectious material, thus secondary infection is prevented

5 Injections of other modifying fluids must, as a rule, be repeated, while with the paste the first injection usually attains the desired result.

6 The injection of bismuth paste is not painful or irritating. It is injected in a warm, semiliquid state, and remains long enough in contact with the diseased tissues to produce its therapeutic effect. The vehicle (vaseline) does not macerate the walls of the abscess. Toxic effects from bismuth subnitrate can easily be prevented

DANGERS AND COMPLICATIONS

The only danger which has been advanced is the possibility of bismuth poisoning. My brothers and myself are fortunate in not having had a single fatal case in our series of cases. We met with the symptoms in one of the first cases of empyema treated, and were able to check the progress and save the patient. This case was reported by me in the *Journal of the American Medical Association*, January 8, 1909, and is the first case on record. I then warned the profession against the indiscriminate use of the paste. It is fortunate that most of these accidents were at once reported in the literature, this has put on guard those who thought that bismuth was an entirely harmless substance. It must have had a very salutary effect, because nearly all the cases of poisoning occurred in the first two years, 1908 and 1909, and the past year only one case is reported, although the bismuth paste is now employed among the majority of American surgeons, and to a large extent abroad.

It is gratifying to know that the poisoning can be prevented, and if it accidentally occurs and is discovered, it can be checked before it causes irreparable damage

PREVENTION OF BISMUTH POISONING

The prevention consists of not allowing large quantities of the paste to remain in the body for absorption. Should the symptoms appear, the paste must be removed by washing out the cavity with warm olive oil. The sterile oil is injected and retained for twelve to twenty-four hours, in order to produce an emulsion, which should be withdrawn by means of suction. After its removal all symptoms will promptly disappear. Scraping out the paste with a scoop is a dangerous procedure, because it opens fresh channels for absorption.

To insure success in employing bismuth paste the essential points are summarized as follows

- 1 One should make a correct diagnosis by all methods at our disposal and corroborate same with stereoscopic radiographs before an injection is made

- 2 Before attempting to employ this method, one should acquaint himself thoroughly with the technic

- 3 The proper instruments should be employed in order to carry out the technic correctly

- 4 The patient should be kept under constant observation to prevent bismuth intoxication

- 5 Examine the secretions from the sinus before the first injection, by slide and culture, and often by the inoculation of guinea pigs, then three days later test the sterilizing effect of the injection

- 6 As long as the sinus contains microorganisms it should be reinjected, but if it is found sterile, it should not be re-injected

- 7 It is good practice to wait at least one week after the first injection before repeating it

- 8 A stereoscopic radiograph of the parts affected should always precede the first injection, in order to detect the

the coils of intestine exposed by the incision, and these coils were drawn apart by dividing the delicate adhesive films connecting them until the ascending colon and the cæcum with the appendix were eventually liberated and uncovered. All these structures and the adjoining coils of small intestine and the parietal peritoneum were bound together by delicate but firm adhesive films, and the whole area presented many tortuous dilated capillaries. The appendix when identified was found passing downward and backward underneath the ileum and thence to the pelvis below, and was bound throughout its whole extent to the ileum by an adhesion film. It was the subject of a chronic inflammatory thickening. It was enucleated and removed in the usual manner. The ascending colon was traced up to the hepatic flexure, and the restraining film in a large degree removed from its surface. At this point operative interference was suspended and after toilet of the region had been made with hæmostasis wound was closed. Operative recovery was uncomplicated. Ultimate result, entire relief from the symptoms for which the operation had been performed. The patient's condition was unmistakably the product of acute local inflammatory attacks, the previous symptoms of which as detailed in his history are clear enough and are doubtless due to bowel changes consequent upon the typhoid ulcers when thirty years of age. To the eye of the operator many of the filmy areas exposed in this case were identical in appearance with those which he had seen in the other and less severe cases of pericolitis.

CASE IX — *Definite pericolic membrane covering in the ascending colon, reflected from lateral parietes, with strong band-like process extending up to gall-bladder and right hypochondrium, appendix chronically inflamed, sharply angulated and bound to cæcum and adjacent ileum by strong band-like adhesions which kinked the ileum* (Hospital No 261)

Female, thirty-two years of age. A neurotic young woman well nourished, who since she was eight years of age has been the subject of a series of digestive troubles. Throughout her history there has been a marked tendency to constipation. At the age of nineteen, 13 years ago, she had an attack of severe pain referred to the upper abdomen, which lasted for three or four hours and was followed by a sense of epigastric tenderness for several days. Two years later she had a similar attack. Seven years later she

presence of sequestra or foreign bodies The shadow of the paste might make their presence obscure

9 Following the injection, a second set of stereoradiographs should be taken in order to make a correct anatomical diagnosis.

10. In case a foreign body or sequestrum is present, the injection is useless, operation the only means

11 Acute suppurative processes should not be treated with bismuth paste, only chronic suppurations, both tubercular and non-tubercular

12 Bismuth poisoning may be easily prevented by using only small quantities, or when large quantities are required they should not be retained longer than ten days, and patient should be carefully watched

13 Fecal fistulæ and other post-operative sinuses are very favorably affected by bismuth paste treatment

14. A ten per cent bismuth-vaseline may be used in cold abscess In practically all instances the secondary infection can be prevented, providing the technic is carefully observed

THE NATURE OF SHOCK.

ITS RELATION TO ACAPNIA AND TO CHANGES IN THE CIRCULATION OF THE
BLOOD AND TO EXHAUSTION OF THE NERVE CENTRES *

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It is the object of this paper to present the results of a series of experiments which furnish information regarding the relative etiologic importance of acapnia, of reflex changes in the circulation of the blood and of exhaustion of the nerve centres in shock produced by three methods. Crile has concluded as a result of a long series of experiments that the primary change wrought by all causes of shock is a fatigue of the vasomotor centre. As a consequence of this fatigue there is a continuous lowering of the blood-pressure until the cerebral centres, particularly the medullary centres, no longer receive sufficient blood to enable them to functionate normally, and from this cause, in fatal cases, life becomes extinct.

This theory has received the recognition to which it is entitled by the high character of all the work of its chief advocate. The protocols of his experiment demonstrate the close relation between low blood-pressure and shock. At present the theory is made the basis of a method of anæsthesia which is believed to diminish shock in operations, and is rendered conspicuous by having been christened with a new name.

No one can fail to admit the important association of a diminution of blood-pressure with the onset and development

* Read in the Section on Pathology and Physiology of the American Medical Association, at the Sixty-fourth Annual Session, held at Minneapolis, June, 1913

of shock. Every writer has felt obliged to admit its bearing on the problem of shock. Nevertheless, a rather large number of writers since the publication of Crile's work have been unable to believe that any of the series of events, including the low blood-pressure itself, which may result in shock is, at the start, a process of fatigue of the nerve centres. Meltzer has discussed the whole question at length in a review of all the more recent theories of the nature of shock. He presents many observations of others and adds the results of his own experiments to show that the primary changes in the human body leading to the development of shock is not fatigue of the nerve centres but an inhibition of their activities. Differing from Crile, he quite justly questions the legitimacy of distinguishing etiologically between shock and collapse.

During the past winter we have performed experiments in connection with the production of shock by three methods. These experiments in agreement with the views of others, particularly of Howell, Porter and Meltzer, demonstrate, first, that a low blood-pressure is an important symptom of shock, but that an animal may pass into shock with a blood-pressure which is still far above a point below which the nervous system fails to functionate normally; and, second, that changes in the frequency of the heart and its output per beat always accompany shock, even in the earliest stages, but that it is very unlikely that changes either in the blood-pressure or in the force and output per beat of the heart are inaugurated by fatigue of the nerve centres. Our experiments indicate that shock in its incipency in some cases is of reflex, and in other cases of local peripheral origin.

From the practical as well as the scientific point of view the causes inaugurating shock are the most important. It matters little that a low blood-pressure may cause the death of an animal already in fatal shock. We wish to know what are the causes leading to shock before the blood-pressure begins to fall, and how to prevent these causes from becoming active.

Yandell Henderson has sought an explanation different from that of all other writers. He concludes from a large

the artificial respiration and then decreased more slowly to between 40 and 50 mm of mercury. After the cessation of the experiments, the blood-pressure rose from 60 to 90 per cent within a few seconds.

The carbon dioxide content of the arterial blood at the end of the experiments was from 38 to 44 per cent of its original amount. The amounts of carbon dioxide and oxygen were measured in all experiments reported in this paper by the Barcroft-Haldane method. At the end of the experiment the animals were in deep shock. One died the next morning, one in two days and the other two lived three days. None of them died of the immediate effects of the experiment, but from secondary effects. They had recovered from the shock and their lungs at necropsy showed interstitial emphysema. In all these experiments it was found that the amplitude of the pulse and the blood-pressure was proportional to the pressure at which the lungs were inflated and, therefore, to the intrathoracic air-pressure. The amount of shock which was produced was proportional to the length of time that certain pressures, which we may term critical intrathoracic pressures, were maintained. The carbon dioxide content of the arterial blood could be easily reduced to from 40 to 50 per cent of its original amount within half an hour, but in four other experiments when artificial respiration was maintained for only this short period, we found that no shock resulted. It has been assumed by Henderson that a long-continued acapnia, lasting two to three hours, results in a depletion of the tissues' store of carbon dioxide by osmosis, and accompanying this osmosis of carbon dioxide from the tissues into the blood, water passes from the blood into the tissues. As a consequence, a diminution of the total volume of the blood ensues. The associated general muscular relaxation dependent on the changed chemical composition of the muscles contributes to the diminution of the general blood-pressure by no longer affording the proper support to the veins. Thus the venopressor mechanism is also disturbed and, with it, the proper balance of the distribution of the blood in the body.

In our experiments the force of the artificial respiration necessary to produce acapnia was so excessive and the degree of shock and the change of blood-pressure so closely proportional to the intratracheal pressure that the air-pressures, at which the artificial respiration was given, seemed to us to be the most important factor in the production of shock by this means. We therefore performed three experiments in which the same conditions of artificial respiration were maintained, but with the provision against the loss of carbon dioxide. In all three precisely the same conditions of artificial respiration were maintained as in the first set of experiments, but, by inserting a rebreathing bag in which the expired air was collected and from which that blower was supplied which furnished the

amount of experimental work that acapnia can be one of these causes. He believes it to be the essential cause in shock produced by artificial hyperrespiration and by prolonged exposure of the intestines, and may be a cause of that form of shock produced by severe stimulation of afferent sensory nerves.

In all experiments performed by us, dogs were used. Each animal received 0.005 mg of morphin for each kilogram of body-weight. Sufficient ether was given during each experiment to produce full anæsthesia.

SHOCK AND ARTIFICIAL HYPERRESPIRATION

In the first series of experiments that form of shock was considered which was produced by artificial hyperrespiration.

A suitable time after the injection of the morphin the animal was etherized and a rubber tube introduced through the larynx into the trachea. By means of two rotary blowers and an intervening slide-valve which regularly threw first the exhaust of one blower and then the intake of the other blower into connection with the intratracheal tube, air was alternately forced into and sucked out of the lungs. The slide-valve was operated by another electric motor than either of those turning the blowers. Its speed was regular and could be controlled by a rheostat, and the frequency of the interruption of the valve which it operated could be varied as occasion demanded. By means of by-passes in series with the exhaust of the blower used to inflate the lungs, and the intake of the blower used to deflate the lungs, the amount of air used for the artificial inspiration and expiration could be varied at will. In these experiments the intratracheal catheter did not tightly fit the trachea. Provision, therefore, was made for the escape of any excess of air forced into the lungs during the inspiratory phase around the intratracheal tube, and the same factor of safety controlled the expiratory phase. We found, without this provision for a certain latitude in the amount of air used to inflate and deflate the lungs, that sudden death from excessive variations of pressure within the chest could occur. As will be developed, this fact is in accord with our own belief as to the cause of shock produced by excessive artificial respiration.

In four of these experiments which we have performed, the artificial respiration varied from 60 to 70 times a minute, and the lungs were as completely inflated and deflated as is possible with a closed chest. In order to accomplish such a filling and emptying of the lungs at a rate of from 60 to 70 times a minute, the air must be forced into and sucked out of the trachea under considerable pressure. Two of the experiments were continued for three hours and two for two hours. In these experiments the blood-pressure fell 40 per cent within a few minutes after starting

could be made to furnish continuous insufflation. In one experiment taken as an example, with an increase of intrabronchial pressure from 8 to 30 mm. Hg, the blood-pressure sank from 122 to 55 mm Hg and the volumetric tracings of the cardiometer showed a diminution of cardiac output of 44 per cent. In another experiment the blood-pressure rose 15 mm Hg each time the interrupting valve reduced the intrabronchial pressure from 6 mm to 0. These variations of blood-pressure were completed within a few seconds after the change in intrabronchial pressure and could be duplicated at will. A rise of intrabronchial pressure above 8 or 10 mm Hg always caused a fall of blood-pressure proportional to the rise of intrabronchial pressure.

It is evident, therefore, that excessive intrabronchial pressure, such as always accompanies violent artificial respiration even at from sixty to seventy times a minute, is quite sufficient in itself to account for a continued diminished cardiac output and low blood-pressure.

VENTILATION OF THE ABDOMINAL CAVITY.

We next studied the relation of acapnia to that form of shock produced first by exposure of the intestines to a current of warm moistened air passed over them beneath a celluloid cover, and second, by evisceration and handling the intestines.

A portion of the anterior musculature of the abdomen was excised, the omentum cut away and a celluloid window fitted in place between the layers of the muscles left at the side in such a manner as to completely cover the intestines. A current of warm and moistened air was then passed beneath the celluloid over the covered intestines. The air entered through a tube piercing the celluloid at one end of the abdomen and passed out through an opening at the other end. Aëration of the abdominal cavity under these conditions for a period of three hours produced no shock in one experiment and little reduction of the carbon dioxide content of the blood. Through the celluloid it could be seen that no drying of the peritoneal surface occurred. The intestine remained a good color, and peristalsis was almost absent at the end of this time. The blood-pressure was 163 mm Hg. The celluloid membrane was then removed, the intestines spread out and the aëration continued for forty-five minutes longer. The blood-pressure was then 153 mm and the carbon dioxide content of the arterial blood was 38.8 volume per cent. The intestines were then handled and in ten minutes the blood-pressure had fallen to 80 mm, and in twenty minutes to 56 mm. After even ten minutes longer there was 31.6 volume per cent of carbon dioxide in the arterial blood.

As a check to this experiment another experiment was performed. The abdomen was opened by cutting away the anterior wall. The in-

air to the dog's lungs, and supplying to the fresh air required to be added during the experiment a proper proportion of carbon dioxide from a tank, the amount of oxygen in the blood was unchanged at the end of the experiment and the amount of carbon dioxide raised only slightly above the normal. All of these animals presented the same degree of shock at the end of their period of artificial respiration (two hours) as the animals of the first series. In these experiments, also, the shock was directly proportional to the air-pressures used during the artificial respiration.

Clearly, then, the shock produced by artificial hyperrespiration was not due to a diminution of carbon dioxide but to some other factor which is dependent on increased intrathoracic pressure. Of the effects produced by increased intrathoracic pressure, the one first suggesting itself as the most important and, as far as we can conceive, the only one bearing on the problem of the cause of this form of shock, is the interference of the venous return to the heart. By venous return to the heart, not only the return from the systemic circulation is referred to, but also the return from the pulmonary veins. The latter is affected in two ways, first, by direct pressure around the pulmonary artery, and second, on capillaries and veins within the lungs themselves. The pressure on the pericardium required to alter the general blood-pressure is much above that which affects the circulation when applied to the great veins at the base of the heart. This factor, therefore, can be neglected in these experiments. The most direct manner of measuring the effects of increased intrathoracic pressure on the circulation is to measure the output of the heart, and a third series of experiments, four in number, were devoted to this investigation.

The thorax was opened laterally, and a T-tube connected with a water manometer was tied in a small bronchus. The heart was then enclosed in a Henderson's cardiometer in circuit with a recording tambour. The blood-pressure was recorded from the carotid artery. The thorax was then closed and the animal subjected to intratracheal insufflation from an apparatus provided with an exhaust-valve which reduced the pressure to approximately zero from four to twelve times a minute, or

Deep degrees of shock were produced by handling the intestines in six dogs, as described before, for two hours. At the end of this time each animal was in a deep degree of shock. Their eyes were immovable in the orbits and drawn down and inward beneath the conjunctiva. They were absolutely irresponsive to sensory stimulation. Their muscles were relaxed, respiration was shallow, the surface of the body cold, and the pulse rapid and diminished in amplitude. In one of the dogs the transfusion was given immediately after the period during which the intestines were handled, in the others it was given at varying intervals up to one hour after the intestines were handled. Recovery from the shock followed transfusion in all of the dogs. In four of them immediately after the transfusion their eyes regained the normal position in the orbit. The recti muscles of the eyes recovered from their previous relaxation. The dogs voluntarily moved their legs and became responsive to external stimuli. Immediately after the transfusion three of them ran around the laboratory so that they were obliged to be tied up in order to keep them confined. Running around seemed to cause them no discomfort whatever. In two of the dogs which were not transfused until an hour after the experiment, and with which the blood-pressure had been allowed to reach a very low point during this hour, the recovery was less complete, though unmistakable. Following this improvement all of the dogs remained for a long time in about the same condition but permanent recovery was never obtained. They gradually manifested signs of increasing abdominal distress, becoming in consequence more quiet, and died some time during the following night. The temporary improvement after the transfusion described was only the well-recognized improvement regularly following transfusion in shock from any cause. Nevertheless we believe that these transfusion experiments on animals in shock from evisceration of the intestines afford information regarding the nature of shock when carefully studied themselves, and when taken in connection with the control experiments and other experiments about to be described.

The first significant fact to note, and one previously emphasized by Howell and Meltzer, is the comparatively high blood-pressure at the end of the period of intestinal manipulation. Only two of the animals had a blood-pressure approximating 50 mm Hg. In all the other animals the reduction of the blood-pressure had been as follows: from 104 to 90; from 114 to 54, from 119 to 75, from 115 to 46, and from 105 to 80. The same failure of the blood-pressure during the period of the production of the shock to fall to a dangerously low point was noted in the control experiments; namely, from 116 to 84, from 118 to 67, from 110 to 94; from 102 to 90, from 145 to 88, and from 129 to 101. The one animal

testes were exposed by cutting away the omentum and warm, moistened air passed over them. A long tube was inserted into the trachea in order to preserve the normal amount of carbon dioxide in the blood. At the end of one and one-half hours the blood-pressure had not changed and the animal was in good condition. The intestines were then handled and in ten minutes the blood-pressure fell from 122 mm Hg to 60 mm Hg. The carbon dioxide content was 45.1 volume per cent. In twenty-five minutes the blood-pressure was 46 mm Hg, the carbon dioxide still undiminished and the dog was in pronounced shock. The sciatic nerve was then stimulated and a rise of blood-pressure to 96 mm Hg was obtained, showing a strong medullary reaction.

These experiments, investigating the relative effects of aerating the intestines and of handling them, justify the conclusion that the manipulation of the intestines and not a diminution of carbon dioxide is the important factor in the causation of shock accompanying exposure and handling of the intestines. We have been unable to find any record among the experiments of Henderson of the production of shock by aerating the abdominal cavity alone within reasonable lengths of time.

SHOCK AND MANIPULATIONS OF THE INTESTINES

In attempting to investigate the mechanism of shock produced by prolonged handling of the intestines, we first sought to establish definite controls. After some preliminary experiments we demonstrated that by handling the intestines violently for one hour, with, it should be remembered, complete anaesthesia, a deep degree of shock could always be produced. In some of these animals the degree of handling of the intestines was sufficient to produce actual rhexis from the peritoneal surface. In our subsequent work we attempted to avoid such a severe degree of handling. We aimed to secure a very intense congestion without actual rhexis. We satisfied ourselves that this degree of handling, in two hours' time could be counted on to produce fatal shock.

Having established this fact we next attempted to discover how far it would be possible to resuscitate dogs from a condition of otherwise fatal shock produced in this manner by transfusion from another dog.

had a much more severe attack. These attacks never were accompanied with jaundice. Since this last attack four years ago she has been very easily exhausted. Bowels have been markedly irregular. Six months ago had a transient attack of pain in the region of the appendix, which lasted for one week. Since that time she has had numerous similar but slighter attacks. During the four weeks previous to coming under our observation she had had continuous pain low down in the right iliac fossa. Examination elicited nothing in the pelvis nor in the epigastrium, but there was a general tenderness over the line of the ascending colon, with its maximum over the appendix.

Operation (January 20, 1912) —The abdomen was opened by a five-inch longitudinal incision through the right rectus muscle with its centre opposite the umbilicus. The gall-bladder upon exposure appeared normal, but there extended from it to the hepatic flexure of the colon a rather long, dense band of adhesion. After this band had been divided the exposed ascending colon was found to be covered by a rather thick membranous veil of adhesion binding it to the lateral abdominal wall. Running in this veil were many small venules. This veil was stripped off until the entire ascending colon was free. The wall of the cæcum was thickened but not covered by this membranous veil. The appendix was sharply angulated and confined by a short, thick meso-appendix, which was bound in with the head of the cæcum and the adjacent portion of the ileum by a fibrous band-like formation which constricted and angulated the ileum. These various structures were freed from each other, and the appendix removed. The appendix was found to be in a state of chronic inflammatory thickening. The operative recovery in this case was uncomplicated, and the specific relief from the symptoms from which she had suffered was very marked.

CASE X —*Vascular membraniform veil springing from right lateral parietes reflected over ascending colon, upper portion thickened into a distinct band constricting colon at hepatic flexure, chronic appendicitis, ileac kink* (Hospital No 267)

Male, twenty-one years of age. An active, athletic young man who was enjoying good health until six months ago, when he took part in a long distance running race. He finished the race but was so exhausted by the effort that he was confined to his bed for a week thereafter. Since that time he has been subject to frequent

which recovered ran around the laboratory in an apparently normal condition with a blood-pressure of 50 mm Hg

These facts demonstrate that at the end of the period during which the intestines were handled the nerve centres must have been supplied with sufficient blood to enable them to functionate properly in the absence of any other disturbing factor

The second significant point was the very rapid recovery by the animal of his normal condition after transfusion. In other words, an animal in a deep degree of shock which our control proved would have certainly died in a few hours' time with a progressively falling blood-pressure, and in a number of instances with a blood-pressure which had already shown the first steps of this progressive fall, could immediately be resuscitated by transfusion. This rapid recovery precludes the idea that the other disturbing factor to which reference has just been made was an exhaustion of the nerve centres. We cannot conceive of an exhausted centre recovering so quickly. The fact that in our experiments the dogs spontaneously got up and played around and responded normally, as they did, to whistling, indicates that their cortical centres had not been exhausted by sensory impulses. There is no reason to assume that these impulses evoke a greater response in the medullary centres than in the cortical centres. Our deduction, therefore, that the medullary centres were not exhausted or even fatigued is justified. We draw no distinction except in degree between exhaustion and fatigue.

This conclusion is in accord with the results of Porter's experiments which furnish strong evidence that the medullary centres are not exhausted in shock. Porter obtained in numerous experiments a greater percentage rise of blood-pressure by stimulating the sciatic or vagus or splanchnic, or a greater percentage fall by stimulating a depressor nerve after the blood-pressure had been reduced in shock than before the shock had been produced. With a low blood-pressure the same strength of stimulus would probably be more effective both because the vessels may be dilated and because their walls

duction The blood-pressure averaged, for instance, at the start of the experiment, during the period of stimulation and after the litter was discontinued respectively 150, 120 and 110 in the first animal, 90, 120 and 100 in the second, 130, 176 and 140 in the third, and 96, 116 and 74 in the fourth

These dogs required considerable ether, which regularly lowered the pressure each time it was applied At the end of the experiment all four dogs recovered promptly Immediately after the experiment the frequency and amplitude of the pulse was good It compared favorably with that at the beginning In one hour's time one of the dogs responded normally to his environment, the other three in four hours' time

There was certainly little difference in this manner of recovery from that which would be presented by another animal which had received an equal amount of morphin and ether.

These statements are emphasized by the differences presented by animals in which the same prolonged severe stimulation of the sciatic and brachial nerves was conducted after the animal had lost the power of controlling his blood-pressure by a preliminary division of the great splanchnic nerves Three of these experiments were performed In one animal at the end of fifty minutes' stimulation the blood-pressure had fallen to 14 mm Hg, death following a short time later. The second withstood a continuous stimulation for two hours; at the end of this time the blood-pressure was 77 and the animal was in deep shock, in three hours' time he was in still deeper shock and he was killed in five hours' time The third animal recovered from the immediate effects of the experiment

The relation of diminished blood-pressure to the production of shock in association with the stimulation of sensory nerves was intensified by bleeding the dogs after the splanchnics had been divided One of these experiments was performed after division of both splanchnics, 200 c c of blood were withdrawn, reducing the primary blood-pressure from 152 to 70 The sciatic and brachial nerves were then stimulated as in the preceding experiment The animal died in deep shock before the conclusion of the experiment

In four other experiments dogs were bled until the blood-pressure fell to a degree comparing favorably with the fall produced by dividing the splanchnics and the sciatic and brachial nerves were then stimulated for two hours All four

meet less resistance during contraction. Nevertheless, the absolute rise or fall in Porter's experiments was very great and the experiments furnish strong evidence of the absence of fatigue in the primary stages of shock.

In one experiment we have confirmed the results of Porter's work. A dog was thrown into deep shock by one and one-half hours of violent artificial respiration. On afferent stimulation of the vagus, or sciatic, or stimulation of the splanchnic, a percentage rise of blood-pressure of almost 100 could be obtained. The absolute rise was practically the same as at the beginning of the experiment before the shock had been produced, namely, 30 mm. Hg.

Those who have explained shock as primarily an exhaustion of the nerve centres assume that the blood-pressure in an unconscious animal falls because the medullary centres respond to afferent sensory stimuli and thus dissipate their energy. Numerous experiments have been reported by others in which animals have been thrown into deep shock by prolonged crushing, tearing, and electrical stimulation of sensory nerves. The results of these experiments have been interpreted as demonstrating the power of prolonged and strong afferent stimulation to exhaust the nerve centres. They have been used to explain the shock following serious injuries or operations and of the various methods of producing experimental shock. If, however, these results are used to interpret other forms of shock, they should parallel, particularly as regards time, the actual conditions of the accidents, operations or experiments which they are used to explain.

We have performed experiments of this kind. The animals have received the usual dose of morphin which has been used in all the work presented in this paper. They were then etherized. The sciatic and brachial nerves were dissected out and a strong faradic current applied for two hours to the nerves. Much tearing and crushing of the nerves was incidental to the experiments. During the period of stimulation the medullary centres were certainly active and presumably dissipating energy. This was proved by the hyperpnœa and rise of blood-pressure maintained during the experiment. As soon as the stimulation was discontinued there was a definite fall of blood-pressure, never, however, to a degree which either indicated shock, or could be of any significance in its pro-

CAUSE OF SHOCK PRODUCED BY MANIPULATION OF THE
INTESTINES

Returning again to the interpretation of the experiments in which shock was produced by prolonged handling of the intestines and in which attempts were made to resuscitate the dogs by transfusion, the quick recovery precludes the idea that the nerve centres had been exhausted. It does not, however, negate the possibility of the condition of the animals at the end of the period of intestinal handling being due to cerebral anæmia in combination with the anæsthesia which had been used. While the blood-pressure was still far above a level which would prostrate an animal wholly out of anæsthesia, there was little difference in the condition of these dogs and similarly anæsthetized dogs whose blood-pressures had been reduced to a similar degree by hemorrhage. Cerebral anæmia, however, is a far different condition from exhaustion of the nerve centres, a state demonstrated to be absent, as we have repeatedly emphasized, by the rapid recovery after transfusion.

But as has been stated, with the fairly high blood-pressures recorded in these experiments cerebral anæmia could have contributed little to the degree of shock exhibited by the animals. Many facts indicate that cooperating with the cerebral anæmia, inhibitory impulses are important causes of the animal's condition at the end of the period during which the intestines are handled. On the cessation of the handling there would be a return of a reflex response of the animal indicating semiconsciousness. An immediate relapse into an insensitive comatose condition could be produced by continuing the handling. The blood-pressure usually fell when the handling was stopped and rose again under the stimulus of handling, though this was not a constant effect. We know that afferent impulses of possibly an inhibitory nature are present. It is due to them that these experiments of evisceration and intestinal manipulation may be performed at times without the continuous use of a specific anæsthetic other than morphin and the preliminary anæsthesia, and yet without any evidence whatever of feeling on the part of the animal. There

of the animals developed deep shock, one of them recovered with the aid of an infusion and was alive the next day, another recovered spontaneously, though he did not stir when disturbed; another died during the experiment from excessive anæsthetization, and the fourth succumbed from the experiment. On the other hand, animals subjected to similarly caused reduction of blood-pressure and equal periods of anæsthetization by ether, but not to the prolonged sensory stimulation, suffered from a degree of shock which we were unable to distinguish from that of the stimulated animals which were similarly bled. It must be remembered in this connection that the latter required more ether. We have performed three such control experiments and are satisfied as to the truth of this statement.

As soon, however, as the animal's blood-pressure was reduced and the animal was deprived of his power of compensating for lowered blood-pressure by paralysis of the splanchnic area, serious shock developed but always in proportion to the diminution of blood-pressure and not greater than in animals in which the blood-pressure was reduced to a similar degree by hemorrhage alone.

In shock produced by prolonged handling of the intestines it seems that much less severe sensory impulses can be present than occur in stimulation of the sciatic and brachial plexus for the same length of time. Consequently, if sensory impulses in an unconscious animal were not effective in producing shock by causing exhaustion of the central nerve cells in the absence of vasomotor control, it is not likely that they are the important factors in the production of shock by prolonged handling of the intestines. Simple division of the splanchnic, as we ourselves have also experienced, does not in itself result in a lowering of the blood-pressure sufficient to produce shock. Within the time limit which we have adopted in these experiments, which is quite sufficient from the practical point of view of the operating surgeon, the exhaustion of the nerve centres by afferent stimulation of sensory nerves is a wholly negligible factor in the production of shock.

possible, that which the vasomotor centre uses to produce its rise and fall of pressure and without which it is powerless, is hopelessly unavailable

The amount of blood which this area will contain is well illustrated by a number of experiments which we performed, in which during the period of handling the intestines, the brain of the same animal was supplied with blood from the carotids of another dog, and in one case from the carotids of two other dogs. Before the intestines were handled, an anastomosis was made between the carotids and external jugular veins of the donor and the recipient, which was to be shocked. The purpose of these experiments was to discover whether or not any diminution of shock could be obtained by supplying the dogs being shocked, with blood from a presumably normally beating heart, thus eliminating the small fall in pressure occurring in the other transfused dog, during the experiment. In general the dogs gave the same result as the dogs transfused at the end of the experiment. The main purpose of the experiment was defeated, however, by the fact that the splanchnic area of the recipient during the period in which the intestines were handled drained off so much blood from the donor and in one case from two donors, that the blood-pressure of all donors in the three experiments fell to a serious degree, so that at the end of the experiments the donors no longer supplied the brain of the recipient with blood under good pressure, and were themselves in a serious condition from exsanguination.

Animals shocked in the manner described are deprived of all vasomotor control solely because of a local peripheral paralysis of the splanchnic area. It is as though the branches of their mesenteric arteries emptied into a large reservoir with perfectly flaccid walls, into which they bled to death. The aptness of the comparison of the splanchnic area to a flaccid rubber bag is made more apparent by pressure on the abdomen. The blood-pressure can be raised at will by this procedure. The explanation of the secondary shock developing in the transfused animals, the intestines of which are paralyzed from one end to the other, introduces very complex questions which

is no physiological reason for distinguishing between shock and collapse. The latter condition is entirely due to inhibition. Howell and Meltzer have presented additional evidence that inhibitory impulses are important factors in this stage. They unquestionably are responsible in the beginning of the experiment for the onset of shock and the first fall of blood-pressure. If they are then operative they must continue to be during the whole time during which the intestines are handled.

Following the period during which the intestines were handled in those animals in which the shock was produced for control purposes and which were not therefore transfused, there occurred a progressive fall of blood-pressure within the next few hours until death occurred. The progressive fall was often initiated by a considerable drop at the start. This progressive fall was unquestionably due to bleeding into an absolutely paralyzed splanchnic system. During this period we have found that stimulation of the splanchnic nerves produced no rise in blood-pressure, or change in a plethysmographic tracing measuring the amount of blood in the splanchnic area. There were even no indications of blood-flow through the intestinal vessels.

The local peripheral character of this vascular paralysis has been clearly shown by two experiments. A coil of intestines was protected in a plethysmograph during a period of handling of the intestines for one hour and one and one-half hours. The splanchnic nerve was stimulated and the diminution of volume within the plethysmograph recorded before and after the period during which the intestines were handled.

The protected loop and kidney showed a marked change in volume both before and after the period of intestinal manipulation, while after this period a loop of the handled intestine showed no change.

There can be no question therefore about the extreme paralysis of the splanchnic area after two hours' handling of the intestines. There is an absolute paralysis of every tissue of the intestines, of the muscles, of the intestinal walls and of the arterioles. There is an absolute abolition of all reflexes. The great means by which vasomotor changes in the body are

8 The all-important factor in the development of shock, in so far as the forms which we have studied may represent shock in general, is loss of vasomotor control. It is, at least, the impossibility of regaining this control after it has reached a certain degree which determines the failure to recover. The mechanism of this loss and its maintenance is important. The loss of control and its maintenance is never caused by acapnia or central nervous exhaustion, but, aside from afferent impulses more especially splanchnic sensory impulses which may have initiated the shock and contributed to it, the loss of control was always due to local peripheral causes which in our work were mechanical obstruction, loss of blood and trauma to the viscera.

The practical conclusions from these observations emphasize the necessity, in attempting to prevent shock, of providing against a fall of blood-pressure and local trauma, particularly within the abdomen, as the most important of all precautions. The truth of this statement at present is so generally acknowledged that it is almost trite to make it. Nevertheless the conclusions, indicated by the experiments in which unsuccessful attempts were made to produce shock by trauma to peripheral sensory nerves, will not be generally accepted. They directly contradict grounds on which the method of anæsthesia known as anoci-association is based. We appreciate that our experiments are few. Nevertheless, a study of their details demonstrates that their results were decisive and that severe trauma both electrical and mechanical of peripheral somatic nerves in an unconscious animal within reasonable time limits did not result in either a reflex fall in blood-pressure or exhaustion of the nerve centres. Its influence as a cause of shock at least in so far as the three forms of shock which we have studied may serve as examples of shock in general is so small that it may be practically neglected. In this connection it must be remembered that shock following burns is toxic in its nature.

However valuable the blocking of sensory nerves during operation may prove, the explanation is not to be found in the protection which it may insure against fatigue of the nerve

are not concerned in this paper. Suffice it to say that the animals remained in good condition with high blood-pressure in one case—the only dog watched till death—for twelve hours, and that they rather suddenly passed into a moribund condition.

CONCLUSIONS

Our conclusions, which we hope to support by more numerous experiments, and by reporting them in greater detail in the future than has been possible in this paper, are as follows:

- 1 As severe a degree of shock may be produced by artificial hyperrespiration, and by handling of the intestines when provision is made for keeping the carbon dioxide content of the blood high, as when it is allowed to fall to 40 or 50 per cent of the normal

- 2 Shock produced by artificial hyperrespiration is due chiefly to a long-continued, mechanical interference with the return of the blood to the heart

- 3 There is evidence that the early stages of shock produced by evisceration and handling of the intestines is due to inhibitory afferent impulses

4. At the end of the period during which the intestines were handled none of the animals' nerve centres were exhausted

5. By such handling of the intestines a complete splanchnic paralysis of local peripheral origin is produced, and it is this paralysis which causes the subsequent fatal fall of blood-pressure and not exhaustion of the nerve centres.

- 6 In the presence of a good blood-pressure and unimpaired vasomotor compensatory mechanism, prolonged afferent electrical stimulation for two hours will not produce shock or exhaustion of the nerve centres.

- 7 If trauma to the sensory nerves is a factor in production of shock in an unconscious animal, it is wholly subsidiary to other factors, and it is questionable whether it was apparent in our experiments even when these other factors had rendered the nerve centres more vulnerable by toxic influences, as ether, or by a fall in blood-pressure.

normal The infective process diminished, the temperature fell to normal and the wounds under daily dressing healed slowly, the sloughs separating and granulations of a healthy character soon closing the wounds At the end of a month the urine was free from sugar, acetone and diacetic acid, and the patient left the hospital with wounds healed, having escaped amputation and with his diabetes much improved He continued on a strict diet, his diabetes was held in check until he died of cerebral apoplexy eighteen months later.

CASE II—A Jewish woman, fifty-one years old, whom one of us (Dr Foster) had seen several times in consultation She loved food and especially sweets, detested dietetic restrictions and pretty well ignored her medical advisers In June, 1912, an acute inflammation of one of the great toes appeared The slight swelling, redness, and heat in this location, together with the pain, at first suggested gout After a week, however, the color began to change to a livid hue which later became purplish The increased heat disappeared and the toe grew colder than the others up to midtarsal joint, and insensitive to touch, although still somewhat painful There was evidence of marked arteriosclerosis of the radial arteries The condition was pronounced gangrene and operation advised The diet had been largely of carbohydrates during the time when the gout theory of causation was entertained and the urine averaged about 200 grammes of sugar *per diem*, there was, however, no evidence of acidosis It was determined to give diet a trial before proceeding to radical measures, and a competent nurse was put in charge A strict dietary was carried out for three weeks before the urine was rendered sugar free During this time the toes did not notably change either for better or worse, but after the urine had been sugar free about a week, the color of the toes began to fade, becoming white and finally normal flesh color At the same time sensation and warmth slowly returned until a complete recovery was made This patient remains well although the diet is only an awful memory and the urine contains sugar

CASE III—A man fifty-two years old, was admitted to the service of Dr Joseph A Blake at the Presbyterian Hospital, with the following history

The patient remembers no illness prior to one year ago when he had a small blood blister on the fifth toe of his left foot This

centres, certainly within the time limits of the usual operation. It is doubtless a wise precaution, on account of the more complicated manner in which reflexes may be modified in the human being than in animals, to block the larger trunks of the sensory somatic nerves when these must be divided. Clinical experience certainly teaches that it is most desirable to block the sensory splanchnic nerves when their trunks or more particularly the region of their plexuses must be subjected to trauma. Such blocking will often spare a patient reflexes which may seriously lower the blood-pressure. But the harmful effects, if it persists, is not due to fatigue of the nerve centres but entirely to reflexes and peripheral changes which may be either secondary to them or the result of other local peripheral causes or both. It is equally important to recognize that vasomotor control may be impaired or lost by peripheral injury alone. The central mechanism seems capable of outlasting the peripheral mechanism every time.

The necessity of guarding against loss of blood is self-evident. Of equal importance is the selection of an anæsthetic which, aside from any consideration of toxicity, does not reduce blood-pressure. Ether does not always fulfil this condition. Clinically and experimentally, unless administered with the greatest care, it strongly reduces the blood-pressure. We have numerous illustrations of this fact among our tracings and are disposed to attribute much of the shock of long operations under ether to this fact and to its toxic effect on nerve tissue and the glandular organs. Nitrous oxide does not possess this disadvantage and is also much less toxic. Crile has in no instance shown his keen appreciation of those factors which make surgery more successful than in his advocacy of nitrous oxide anæsthesia. If the general blocking of sensory nerves only increases the efficiency of nitrous oxide anæsthesia it is for this reason valuable. Its effect in eliminating harmful reflexes caused by trauma, particularly in the region of distribution of the splanchnic sensory nerves, has been explained.

We desire to thank Dr. Holmes C. Jackson and Dr. Frederic S. Lee for helpful suggestions and criticisms.

FIG. 1



colicky pains referred to the right hypochondrium, coming on an hour or so after eating. There was a tendency to constipation of the bowels, but he has been able to accomplish a daily stool. He now complains of slight tenderness over the appendix and of discomfort in the right iliac fossa at times, especially after exertion. Examination shows a marked rigidity of the right lower rectus muscle with some tumefaction in the region of the cæcum and ascending colon, with tenderness upon pressure.

Operation (February 28, 1912) — Usual three-inch longitudinal incision along the outer border of the right rectus muscle. The ascending colon when exposed was found covered by a membraniform veil springing from the lateral parietes and reflected over the ascending colon from the hepatic flexure down to the cæcum, but not covering the cæcum. This veil was quite vascular, and at its upper portion was so thickened that it formed a distinct band which immobilized the colon and constricted decidedly the intestinal lumen at that point. The appendix was, however, thickened and congested by chronic inflammation. The meso-appendix was thickened and from it extended a thick fibrous band which bound the appendix, cæcum, and ileum to the margin of the pelvic brim. When this band was divided the whole cæcum was found to be freely movable. The mobility of the cæcum was still more accentuated when the upper membranous veil had been divided and stripped off. The raw surfaces left by the separation of the adhesions and the division of the bands were covered in by proper sutures as far as possible, the parts placed in the normal relations, and the wound closed. Operative recovery was uncomplicated. The ultimate result was an entire removal of the discomfort and disability for which the operation had been performed.

CASE XI — *Colonoptosis, ascending colon at middle encircled and constricted by membraniform band, cæcum dilated and mobile, appendix elongated but not inflamed, colonopexy* (Hospital No 314)

Female, twenty-three years of age. Patient a neurotic, high strung, but intelligent young woman, had suffered from various intestinal troubles for many years. She was subject to attacks of diarrhoea alternating with constipation. A characteristic condition of intestinal auto-intoxication had developed. From the age of fifteen she had been subject to spells of petit-mal. At the time she came under observation her bowels were fairly regular,

broke and as it had not healed in three weeks a physician was consulted, who examined the urine and found it contained sugar. The terminal phalanx became gangrenous and six weeks later was removed under local anæsthesia. The patient was then placed on a general diet in which the sugar was restricted and for eight months had no further trouble. Fortnightly examinations of the urine showed 13 to 16 per cent of sugar. At the end of eight months, that is two and a half months prior to admission, he noted another blood blister on the fourth toe of the same, the left, foot. Several weeks later a small piece of bone was discharged from the ulcer after which the wound healed. A superficial ulceration then appeared at the base of this toe on its plantar surface. This gradually increased in size during a month and a half until it extended on the plantar surface of the foot as far as the first toe. The patient stated that up to a month previously he had attended numerous banquets and did not restrict his diet. The sugar in the urine ran as high as 2 per cent. During the month prior to admission he had been on what he called a milk and egg diet almost exclusively with rarely an oatmeal day, and the sugar in the urine had averaged about 1 per cent. He had also been compelled to arise several times at night to pass his urine. He thought the amount secreted increased above his former daily average of two litres. His temperature during the month prior to admission averaged between 98° and 100°. His appetite was poor. Bowels were constipated and moved only by taking salts. He never had great thirst and did not lose weight, his average being about 288 pounds. He had no skin lesions and no respiratory symptoms. On admission there was a marked degree of cellulitis in the left foot and leg, with redness, swelling, pain and tenderness extending above the ankle. There was a sinus on the plantar surface which was lined by sloughing tissue and from which a small amount of pus with foul odor exuded. The sinus led to bare bone.

The X-ray (Fig 1) showed a pronounced degree of necrosis and destruction of the fourth metatarsal bone and the first and second phalanges of the fourth toe. There was also evidence of a marked periosteal thickening of the shaft of the third and fourth metatarsal bones. There was evidence also of an osteoporosis in the bones of the other toes. A portion of the first and all the second and third phalanges of the fifth toe were missing. There

be marked arteriosclerosis, as in our third case, or a marked alcoholic diathesis, as in our first case. We believe that in certain cases there is present a process analogous to Raynaud's disease as suggested by the second case. Several considerations suggest that it is possibly the increased amount of sugar in the circulating blood which may have reduced the resisting power of the cells. If the last hypothesis be correct it would explain the amelioration of symptoms following successful dietary regulation, since this regulation lowers the percentage of blood sugar, which is its ultimate object.

It is not our contention that every case of "gangrene" in a diabetic patient is of the type here described. There may occur the "fulminating cases" in which high amputation is clearly indicated. But it is rational to give each case as thorough a course of dietary treatment as possible, especially as the results of surgical treatment are most unsatisfactory.

We wish to give the principles of the proper method of feeding these patients and will go somewhat minutely into the dietary.

What this dietetic regulation should be in a given case depends of course upon the type of the diabetes. The principle involved is the same in all. Excretion of glucose in the urine is purely an overflow of excessive blood sugar. Normally the glucose content of the blood is not above 0.1 per cent. In diabetes, however, it is often three or four times this, or even more. The kidneys do not hold back this excess, hence glucosuria. The object of dietetic treatment is to reduce the blood sugar to something near the normal, and the available measure of success in this attempt is the urine. Hence it follows, no diabetic is to be regarded as successfully treated so long as sugar is excreted.

The means at our command of combating this disorder are purely dietetic. It is necessary to restrict the carbohydrate ingest to an amount that is completely utilized by the patient. At the same time we have to remember that total withholding of carbohydrate for more than a few days at a time may also lead to injury to the patient. The problem then is to find the amount of starch to give.

was calcification of the dorsalis pedis artery, plainly shown as a shadow between the first and second metatarsal bones

The urine on admission was. total quantity, 1515 cc, sugar 3 per cent, glucose 45.45 grammes, acetone moderate reaction; diacetic acid, faint trace, total nitrogen 12.41 grammes, ammonia nitrogen 0.89 grammes. The kidneys excreted 64 per cent. of phenolsulphonthalin in two hours. Although amputation of the foot seemed to be the only thing to do, it was determined to delay as it would not increase the danger to the patient and a trial of suitable diet was advised.

This patient had practically no ability to utilize any carbohydrate, and ingest of gms 20 of starch was followed by the excretion of gms 19.8 of sugar and it required three weeks before a sugar-free urine was secured. In this interval, however, the assimilation limit had been raised appreciably as was evidenced by the excretion of from 3 to 6 grammes of sugar after ingesting 20 grammes of starch. At first there was no evident improvement in the foot, but after two weeks a rather sudden turn for the better occurred and this was coincident with a marked return of the patient's strength and well being. Large pieces of plantar fascia came away as sloughs, the circulation in the foot improved slowly and the sinuses became lined with healthy granulations which subsequently healed, and at present he is walking about and reports that he feels "perfectly well". The urine now remains sugar free, although the present diet contains 160 grammes of starch.

The conditions illustrated by these cases raise an interesting pathological question. In the proper meaning of the term this morbid process is not a gangrene, that is not conceivable in the light of ultimate restoration to normal, and yet the condition cannot be differentiated from some cases of gangrene, as there is present a stasis of the circulation which is almost complete.

Many theories have been advanced as to the nature of the process and its underlying causes. There seem to be several factors, all or any combination of which may be present in a given case. There is, we believe, an infection with micro-organisms in every case and there is no specific organism but the common pathogenic forms. In addition to this there may

sugar for several days the diet is to be enlarged by the method to be mentioned later

On the above diet other cases of diabetes continue to excrete small amounts of sugar after ten days (class 2) As this sugar, even though trivial in amount, indicates that hyperglucæmia still persists, and further dietetic change is required, it becomes necessary to interpolate days when the total quantity of food is restricted Naunyn used a starvation day, but the same end may be obtained with less discomfort to the patient by a scheme such as the following:

Morning Omelette of four egg yolks with tomatoes and parsley, 1 large cup of coffee with tablespoonful of cream

Noon One small piece of fish, 50 grammes, spinach with butter or oil *ad libitum*, one glass of claret or whiskey

Four o'clock Cup of bouillon

Evening Asparagus or cabbage served hot with butter, yolks of two eggs soft boiled, tea or coffee (no sugar or cream)

This vegetable day may be used once a week or at most every fourth day The urine of this day must be watched for signs of acidosis When the total sugar excretion has been reduced to five or ten grammes a day and will not reduce further, as occasionally happens, this vegetable day is a potent means of clearing up conditions.

Up to this point no mention has been made of the dietary indications in acidosis When this is a pronounced condition it is necessary to use alkalis at all times and to meet the condition in so far as possible by diet The oatmeal diet gives the best results, and consists of 64 ounces of oatmeal gruel,³ black coffee in small amounts if desired and water *ad libitum* This diet is given solely to combat acidosis, but it not infrequently happens that sugar excretion diminishes or vanishes with its use An oatmeal day may be used once or even twice a week in severe cases, and when the sugar excretion is excessive or obstinate a vegetable day followed by an oatmeal day reduces both sugar and ketone excretion.

³To prepare oatmeal gruel cook in a double boiler, for at least 6 hours, ten ounces of oatmeal in two quarts of water, slightly salted While still hot strain through a sieve and add three ounces of butter and stir well.

First, with regard to those patients who present no evidence of acidosis, the urine gives no reaction with ferric chloride (Gerhardt's test) These cases may be divided for our convenience into classes (1) Where the urine becomes sugar free quite promptly after restriction in carbohydrate, (2) where the urinary sugar falls to trifling amounts, 1 to 5 grammes per day, on restriction of starch, but fails to disappear completely on this diet In both of these classes, without evidence of ketonuria, the diet may be reduced at once to very small amounts of carbohydrate by using meats, eggs, fats, and vegetables that contain little starch The foods that are available for this diet make up Table I

TABLE I

Breakfast¹ Eggs, chops, broiled chicken, fish (fresh, salt or smoked), ham, bacon, tomatoes, onions, mushrooms (broiled or fried), coffee, 1 tablespoonful cream, saccharine to sweeten

Lunch Clear meat broths, meat of all kinds, game, poultry, fish, green vegetables, served hot with butter sauce, spinach, Brussels sprouts, string beans, asparagus, artichokes, salad of lettuce, endive, cucumber or tomatoes, with oil and vinegar, and any kind of cheese

Dinner² Clear broths, *e.g.*, consomme, meats same as lunch, artichoke root as substitute for potato, cabbage, asparagus, spinach, string beans, served hot, gelatine jellies and custards sweetened with saccharine, nuts of any sort, except chestnuts Black coffee (claret or whiskey, if desired)

In addition to these foods it is advisable to begin the diet with an addition of a small amount of carbohydrate, 15 to 20 grammes The reason for this is that certain patients develop quite rapidly a definite acidosis when suddenly deprived of all carbohydrate A slice of bread, three by four inches, and one-half inch thick, will approximate 10 grammes of starch Twenty grammes of starch a day, two slices of bread, is adequate protection from serious acidosis A positive Gerhardt's test may be ignored when the ammonia nitrogen is but 1 or 1.5 grammes per day On this diet many diabetics cease to excrete glucose within ten days After the urine has been kept free of

¹ Part of bread allowance may be taken at breakfast

² The remainder of the day's allowance of bread should be used at this meal

was perfectly conscious, and not suffering much from shock. There was very little bleeding. The interne had tied one small artery on the top of the back of her head. There was avulsion of the right thumb and laceration of the ring finger. To me it was the most frightful appearing trauma I had ever seen in my experience at the hospital.

She stated that she was fixing the washing machine, which was in motion, while making an adjustment she suddenly raised her head. Her hair was immediately caught on a rapidly revolving shaft, winding the hair tightly about the shafting, completely removing the scalp. She put her right hand up to her head in an attempt to free her hair, the hand was caught, the thumb and ring finger were badly lacerated. The patient was alone in the laundry at the time of the accident. As soon as her hair caught she called loudly for help. There was no one at hand so that she was obliged to extricate herself from the machine and walked a distance of twelve feet, where unassisted she stopped the motor. Her hair and scalp were found tightly wound around the shafting. After stopping the motor she sat down in a chair and wrapped a towel around her head. She remained perfectly conscious and was able to give an accurate account of how the accident occurred.

We did not make any effort to cleanse the surface other than to apply hot boric acid compresses. Four days later under ether anæsthesia we covered as much of the right side of the head as was feasible, using Thiersch grafts from the right thigh. Practically every graft we applied at this time grew and became good, firm skin. One week later we covered the left side of the head, using the same method and taking skin from the left thigh. At the second operation we bored a series of rings, using a trephine, through the outer plate of the skull in the area of bare bone, for the purpose of allowing the granulations to grow up and afford a granulating surface on which later we could graft.

On October 28, five weeks later, we found the denuded area covered with healthy granulations. Again with ether anæsthesia we covered this area with Thiersch grafts. This idea occurred to me from a note in an article by Mellish in the *ANNALS OF SURGERY* in 1904 where he quoted a man by the name of Vance, who in 1777 advocated the boring of small holes in the outer plates of denuded bone following scalping by Indians, for the purpose of favoring the healing of the surface by granulation. This pro-

COMPLETE AVULSION OF THE SCALP

WITH A REPORT OF A CASE *

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COMPLETE scalping of an individual is a sufficiently rare accident to make the report of a case of interest. A few scattering cases have been reported in literature until 1910, when Davis, of Baltimore, in an original memoir reported two unpublished cases, one in the service of Dr Bloodgood and the other his own, together with a rather exhaustive review of the literature upon this subject, reporting in all 91 cases of complete scalping, 80 of which were due to machinery. In 53 cases due to machinery the line of tearing included one or both eyebrows, in 19 cases it passed above the eyebrow, while in 8 cases it was not reported. Another interesting fact was that 79 of the 80 cases were females and one male, and he was a Chinaman and caught his cue. There was periosteal defect in 29 of the cases. Fifty-seven cases were grafted with complete healing in 33 cases. The mortality was 10 per cent. Of the other 11 cases of complete scalping which Davis reported, 7 were done by Indians and 4 occurred from other causes.

The case which I now report is that of a woman, who on September 9, 1912, while working in a private laundry, caught her hair in a revolving shaft. The scalp was completely torn from the skull from a line below each eyebrow in front, including the upper half of the right ear and the upper portion of the left ear, back to the hair border posteriorly. This made a denuded area 13 inches by 16 inches. There was an area of denuded bone over the left side of the frontal and left parietal bone, which measured about 7 inches in length and 2 inches in width.

I saw her soon after she entered St Joseph's Hospital. She

* Read before the Syracuse Academy of Medicine, October 7, 1913

but with much flatulence and colonic cramps Bismuth X-ray picture showed a very marked ptosis of the colon, the hepatic flexure falling down two inches below the level of the iliac crest, and the greater part of the transverse colon sinking into the pelvis

Operation (May 20, 1912) —The abdomen was opened by a three-inch longitudinal incision through the right rectus muscle. When the ascending colon and cæcum were brought into view, a distinct, well-formed membraniform band was found encircling the ascending colon at its middle and perceptibly narrowing its lumen. The cæcum was much dilated, was freely mobile, and hung over into the pelvis. The appendix was large but apparently normal in texture. It was removed. The constricting band was divided and the cæcum and ascending colon were fixed above the crest of the ilium to the parietal peritoneum of the right side by three silk sutures which were introduced through the anterior longitudinal band. The transverse colon was then brought up and a series of chronic catgut sutures, six in all, were placed through all the layers of the transverse mesocolon, catching the omentum also below the colon and thence catching the anterior abdominal wall along a line two inches above the umbilicus. The result of these sutures was that the colon was slung from the anterior abdominal wall by a transverse omental hammock (procedure of Coffey). The wound was then closed. The patient made an uncomplicated operative recovery. The later result of the operation has been to give her great relief from her previous intestinal troubles and practically to transform her life.

CASE XII —Pericolic membranous reflection binding first portion of transverse colon and hepatic flexure to right parietes, hepatic flexure constricted, cæcum dilated, appendix chronically inflamed, gall-bladder inflamed and extensively adherent to duodenum, cystic duct impermeable (Hospital No 369)

Woman aged forty-six years. A vivacious, energetic woman, with a history that during the period of years between her twentieth and thirty-fifth year of age she had many attacks of supposed subacute appendicitis. These then ceased to recur and in general she enjoyed good health and led an active life for the succeeding ten years, although she was subject to attacks of so-called gastric disturbances. There was also a tendency to constipation. Five months before coming under observation she experienced a sudden onset of excruciating pain, which was referred to the right hypo-

to be a very valuable means of covering the bare bone. However, before this area entirely healed, a number of small spicule of bone were thrown off, which were the centres of the rings made by the trephine.

In another case I should remove these little plates before placing the grafts. The upper left eyelid at the time of the third operation was retracted and necessitated a graft, to overcome a marked retraction of the eyelid.

Our method of Thiersch grafting is a modification of the regular Thiersch graft, which we have now used for several years, and we find it much more efficient. The grafts are removed in the regular manner, using a sharp razor on the stretched skin. They are then applied to the raw surface, allowing the serum to hold them in place, no solution or moisture being applied. After having covered the desired surface with grafts, it is immediately covered with either bismuth powder or gauze covered with sterilized vaseline, or simple bismuth ointment. This dressing is allowed to remain in place for 4 days, when upon removal, the grafts are found growing much more satisfactorily than when the moist method is used.

Several principles of skin grafting were clearly demonstrated in this case, which I would like to emphasize. First, only autodermic grafts should ever be used to obtain the best results. One so often reads of the self-sacrificing friend or relative, who is placed under an anæsthetic in order to furnish skin so that it can be placed on the injured person. Only about one year ago the newspaper reported the death of one such person, who died while giving his skin to another.

Skin taken from another individual does not grow nearly as satisfactorily as when taken from the individual himself, much less does the skin from animals, etc. In practically all the cases recorded there was either complete or partial failure, and even if the grafts grew, they usually sloughed.

In the case I am now presenting I found it possible to get very good grafts from the same area on the thigh, where I had obtained grafts only 6 weeks previously. All that seemed necessary was not to make the grafts too thick.

11, reports a case of complete avulsion in which he used Thiersch, and Reverdin, and later Wolfe-Krause grafts at different times, starting the grafting immediately after the injury, and not waiting for granulation. He, likewise, found the grafts taken from the patient's relatives at the end of 3 or 4 weeks, dissolved or digested notwithstanding that they grew nicely for 2 or 3 weeks and finally disappeared. He agreed with Davis that the whole thickness grafts when autodermic seemed to give the best results.

Contrary to the opinion of many observers, I have never found that simple ointments macerated or tended to destroy the grafts when autodermic, but on the contrary simple sterilized vaseline with or without bismuth has given me most excellent results as a protective covering in many cases.

My case left the hospital in 67 days, with the head completely covered with good firm skin, but like all of the other cases reported there was a tendency for small ulcerations to form for a short period. In the case reported by Binings, of New York, in the *Philadelphia Medical Journal*, June 7, 1902, he had a similar experience in using grafts other than from the individual herself. It would, therefore, seem that in extensive skin grafting certain principles should be observed. First, that it is not necessary for granulation to form in order to obtain the best results, again, that it is useless to attempt to replace large areas of skin completely separated from the body, and that only autodermic grafts should be used, and that it is possible to secure good grafts from the same area if necessary in 5 or 6 week intervals.

In all of the cases reported, great difficulty has been found in healing small areas of ulceration, which later form as the result of excoriation due either to the wig or lying on the head. Our method of treating these small ulcerations, which we found to be very simple and yet very efficient, was to plant one or two small Reverdin grafts in the ulcerated area. This has always produced very quick and satisfactory results.

In a case of complete avulsion reported by Abbe, it was estimated that over 12,000 grafts were placed before a satisfactory result was obtained. In the two cases reported by Davis, the one in Dr. Bloodgood's clinic was admitted August 24, 1906, was discharged March 8, 1907, but three years later there still existed five small ulcers, the largest being as large as a ten-cent piece. The case had been treated by Thiersch grafts, after first allowing granulation to form. The first graft being taken from another person with total failure, later autodermic grafts were successful.

The second case was injured July 29, 1907, six weeks later a Thiersch grafting was attempted with unsatisfactory results. The following year Thiersch grafts from a lamb were unsuccessfully tried. In May, 1909, nearly two years after the accident Dr. Davis, after thorough preparation and treatment of the granulating surface, grafted whole thickness grafts successfully in about eight different operations. He believed that he obtained much better results than occurred in the cases in which the Thiersch method had been employed.

The question naturally arises in these cases whether it is not possible to replace the scalp if the case is seen immediately. Davis found in his series, that 21 attempts had been made to replace the scalp in complete avulsion, with total failure in every case with a possible exception of one, in which the replaced scalp died, but turned into a parchment-like covering, which remained adherent to the cranium, and under which healing took place without complications. Thus it can readily be seen that it acted only as a form of a dressing, and not in any way as a graft.

Robinson, in *Surgery, Gynecology and Obstetrics*, volume

half years ago disappeared, as the patient stated (probably during a fit of coughing it was drawn beneath the clavicle and was retained in the thoracic cavity); after that, beginning rather acutely, there was a marked increase in the severity of her symptoms which were gradually growing worse

In Case II there was never any sign of any visible goitre, the growth having developed at the lower pole of the gland and extended downward into the mediastinum, during the entire course of its growth, producing such marked narrowing of the trachea as to almost strangulate the patient

This patient had been treated for asthma off and on for ten years, both by internal medication and at various health resorts, and recently underwent operations on the nasal passages with the idea of relieving his symptoms

When both of these patients were seen at the office breathing was extremely difficult and both gave histories of spells in which they were threatened with suffocation

CASE I—T V M, female, age forty-five Married

Personal History—Always been well except for present trouble Has borne two children, ages sixteen and fourteen respectively

Present History—Patient seeks medical aid because of cough and shortness of breath, which has been marked for the past one and a half years and gradually getting worse Patient says that for several years past she has had some enlargement rather low down, in region of left lobe of thyroid gland, about one and a half years ago the mass disappeared and shortness of breath became marked, from which time it has gradually grown worse, past four weeks dyspnoea has been very distressing and has had six or eight spells in which she almost strangulated Her voice has been husky for past six months

Examination—No visible tumor on ordinary respiration but on having patient cough there was noticed a rather marked bulging in suprasternal and supraclavicular region Larynx and upper trachea could be noticed pushed to the right Percussion revealed an area of dulness extending to right of midline downward to third rib and outward to left of midline about three and one-half inches and upward to the lower pole of left lobe of thyroid gland

INTRATHORACIC GOITRE.

REPORT OF TWO CASES WITH MARKED DISPLACEMENT OF TRACHEA

BY O. F. LAMSON, M.D.,

OF SEATTLE, WASH.

THESE two cases of intrathoracic goitre which were recently operated on by the writer, seem to be of sufficient importance to warrant a brief report of their clinical progress and ultimate relief through surgery

The symptoms of these two cases were necessarily chiefly respiratory because of pressure on the trachea, bronchi and lungs, and consisted of coughing, wheezing and dyspnoea which, at times, almost amounted to suffocation.

In the diagnosis, aneurism and malignant growths were considered in both cases, but in the absence of a bruit, thrill and pulsation over the area of dulness, the former was ruled out and malignancy was finally ruled out on account of the chronicity of the symptoms and lack of emaciation

The history of the onset of the symptoms, together with a circumscribed area of dulness, and the X-ray plates which revealed a tumor beneath the sternum extending up to the lower pole of the thyroid gland, with displacement of trachea to the right, led to the belief that the intrathoracic growths which undoubtedly were present, had their origin in the thyroid gland, and the findings in the operating room confirmed this conclusion.

At the time of their appearance in the office, there was a marked similarity in the symptoms the patients complained of, and examinations revealed similar findings; however, there was a difference in the manner of their development.

In Case I there was a cyst which developed at the lower pole of the gland, as it grew, extended downward into the mediastinum, and at the same time there was some enlargement of the thyroid gland in the cervical region, which about one and a

Skiagraph taken twenty-five days after operation shows trachea in normal position

The writer wishes to express his appreciation to Dr Wm Teepell for the most excellent X-ray plates from which the diagrams were constructed

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X-ray revealed shadow in region corresponding to the dulness on percussion, and displacement of trachea to right (see Fig 1, constructed from skiagraph) Examination of throat revealed paralysis of left vocal cords

Operation (June 3, 1913) —Done under local anæsthetic (novocaine) because of marked dyspnœa and fearing that patient would not take general anæsthetic well Large colloid cystic goitre (intrathoracic) removed Patient's breathing improved immediately and she has made an uneventful recovery

Skiagraph taken two months after operation shows trachea in normal position

CASE II—F N S, male, age thirty-nine

Family History—Mother and her two sisters were afflicted with goitres

Personal History—Says he was never seriously ill except for so-called asthmatic spells which have bothered him off and on for ten years

Present History—Patient says he has been troubled with asthmatic attacks for about ten years, coming on intermittently and usually preceded by a slight cold, and worse in winter. For past four years troubled with distressed breathing, wheezing, cough, been gradually getting worse and has noticed some enlargement in region of right lobe of thyroid gland (caused by displacement of trachea to right and not by any enlargement of right lobe of gland) for past two years January, 1913, had a sensation as though he was being strangulated, which persisted for about four weeks, coming on following a slight cold, also a similar spell in June, 1913

Examination—Patient's facial expression one of extreme anxiety, breathing is of stertorous type, face flushed (at times slightly cyanotic) Percussion reveals dulness extending from right of midsternal line to left about three and a half inches and downward to third rib and upward to lower pole of right thyroid gland X-ray revealed shadow in this region, and displacement of trachea to right as in Case I (see Fig 2, constructed from skiagraph)

Operation (July 3, 1913) —Local anæsthetic (novocaine) for same reason as in Case I Removal of cyst resulted in marked improvement in patient's breathing before he left the operating table and his recovery since then has been complete

polished interior of the tube aids in the lighting effect. The amount of the encroachment of the hemicylindrical chamber which holds the light (C) upon the lumen of the tube is regulated by turning the light carrier upon the eccentrically placed proximal end of the tube. It is possible in this way to get ample illumination and, at the same time, make use of instrumentation through the tube without any interference from the hemicylindrical chamber of the light carrier. When the eye is applied to the eye piece, the full field at the end of the tube can be seen without interference to vision.

I have been fortunate in having the advice and assistance of Mr. R. Wappler in working out the mechanical details of this principle. The instrument has been in use for a year and has given satisfaction.

AN ŒSOPHAGOSCOPE WITH DIRECT OUTSIDE ILLUMINATION.

BY NATHAN W. GREEN, M D,

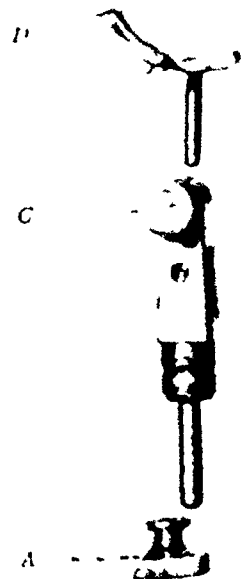
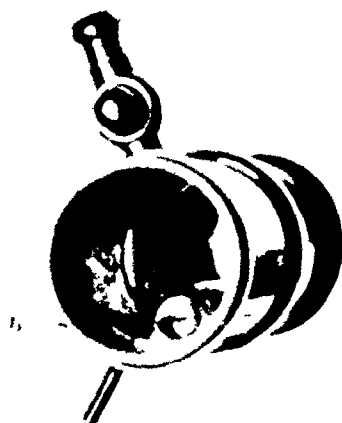
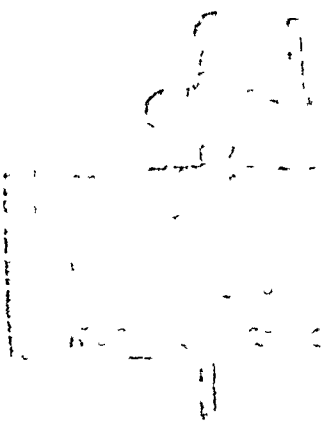
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My object in bringing out this form of œsophagoscope is to have, first, a strong projected illumination with a minimum of light reflexes; second, to have the electrical connections entirely outside the tube, third, to have the electrical connection as simple as possible; and fourth, to have the whole instrument, except the ocular and electric light, sterilizable by boiling. It has also been my object to have a universal light carrier adaptable to any length and size of œsophagoscope (Fig 1).

Description.—In many details this instrument differs from the others now in use. Its principle may be understood by referring to Fig 2.

The tube part of the œsophagoscope (Fig 3) is 48 cm long and 10 mm. in diameter. At the distal end is the usual ring placed to guard against wounding the tissues during introduction (it is entered in the œsophagus over a flexible bougie). At the proximal end of the tube is an enlargement 20 mm in diameter tapered on the outside to fit the light carrier, and conically bored on the inside eccentrically to the axis. This whole proximal end piece is attached to the tube eccentrically. The light carrier is shown in Figs 4 and 5. It consists of a cylinder 52 mm. in length, with an internal diameter of 20 to 22 mm., to fit over the end of the tube. Let into one side of it is a half cylindrical chamber 25 mm in length and 8 mm in diameter. In the distal end of this chamber is a planoconvex lens. On the opposite side of the light carrier is a small piece permitting the introduction of air under pressure when needed. At the proximal end of the light carrier is fitted an air-tight eye piece containing either a plain glass or a lens, as may be required. This is removable when it is desired to pass instruments down the tube. The light is supplied by a high efficiency electric bulb, which is set into the hemicylindrical chamber from the outside. This light can be moved backward or forward by loosening the thumb-screw (A), thereby focussing the light with a certain degree of accuracy at the end of the long tube. The divergent rays are cut down by a small diaphragm which encircles the 8 mm lens (B). The object in this way of dealing with the light problem has been to utilize one-half of a strong electric light, and to throw the parallel rays of the planoconvex lens down the tube as parallel as possible.



FIGS 4 and 5 —Showing component parts of light carrier. Thumb screw 1 for focussing slide D, to which is attached electric lamp C. The focussing is accomplished by moving the lamp toward or away from the small planoconvex lens B.

Operation.—On January 6, 1913, the fracture was exposed and a piece of bone four inches long transplanted from the middle third of the same tibia to bridge the fracture (Fig. 4). Healing occurred by first intention. On May 15, the patient resumed his full duties on the farm. Probably firm union had existed for 6 weeks prior to that time.

CASE A78224.—X-ray 18668. Male, aged twenty-eight. Miner. Examination January 7, 1913. Delayed union of fracture of the middle third of right tibia, $1\frac{1}{2}$ years' duration. There was free motion at site of fracture. Two crutches were used. Amputation had been advised by home physicians.

Operation.—On January 9, 1913, bone was transplanted from the same tibia to bridge the fracture. Instead of using catgut as usual, aluminum bronze wire was used. A scar which was the result of the original accident sloughed after being lifted up at the operation. Under alcohol dressings this surface granulated and healed without infection. The patient did not resume his full duties until September 2, 1913. He wrote that the leg was strong before that time but he was afraid to use it. A medicolegal question in this case may have prolonged the convalescence.

CASE A80259.—X-ray 19480. Male, aged thirty-two. Laborer. Weight 200 pounds. Examined in the Mayo Clinic February 19, 1913. One year previous, he had sustained a simple fracture in the upper third of left tibia. There was delayed union, and at the end of 6 months the fracture was wired, but without resulting union. When he came for examination, he was still using two crutches.

Operation.—On February 22, 1913, a transplantation was done on the same tibia to bridge the fracture. Primary healing followed and the patient was dismissed with a leather-sheath brace and crutches. On May 11, 1913, he slipped, throwing all his weight on the fractured leg. There was an injury and he returned for treatment. X-ray disclosed a new fracture which had occurred at the point where the upper end of the transplant had been removed. The old fracture was intact. A plaster-of-Paris cast was applied. The patient resumed his work on November 20, 1913, and reports the leg to be solid and straight.

CASE A82916.—X-ray 20710. Male, aged thirty-four. Laborer. This patient was examined April 16, 1913. Nine months previous to the examination, he had sustained a simple fracture

chondrium This was relieved by morphia hypodermically, but for some days thereafter the gall-bladder region remained very tender Since the first attack similar ones of varying severity have continued to be experienced at intervals which have gradually grown shorter, until during the ten days immediately preceding her entry to the hospital they occurred every other day Upon admission, in the interval between the attacks, there was no pain nor tenderness nor tumor to be felt in the region of the gall-bladder, there was no muscular rigidity, temperature and pulse normal, there was simply slight tenderness upon pressure in the region of the appendix and along the ascending colon, but she was in a state of panic, apprehensive of the recurrence of her attacks

Abdomen was opened on September 7, 1912, by a five-inch incision through the right rectus muscle from the costal arch downward The stomach, pylorus, and duodenum, first exposed, were found normal The gall-bladder was thick walled and moderately distended A dense band of adhesions united the lateral surface of the gall-bladder to the adjacent surface of the duodenum Continuing the examination along the right side downward, there was brought to view a dense adhesion uniting the right border of the omental apron to the transverse colon, and the hepatic flexure of the ascending colon to the adjacent abdominal parietes When this band had been divided and the parts separated, there still remained several well-marked narrow bands of pericolic membranous formation encircling the colon near the hepatic flexure These were also divided When the cæcum was exposed it was found dilated and the appendix elongated, thickened, angulated, and bound down by adhesions, the centre of a chronic inflammatory process The appendix was freed and removed After all raw surfaces had been covered over by peritoneal suture, return was made to the gall-bladder region The adhesions between the gall-bladder and the duodenum were divided and the gall-bladder opened Its interior contained a moderate amount of tarry mucus, no bile nor calculi The inner surface of the gall-bladder mucosa presented the characteristic strawberry-like state of chronic cholecystitis The gall-bladder fluid contained an abundance of *Bacillus coli communis* as determined both by smears and cultures A drainage tube was inserted into the fundus of the gall-bladder and the operative wound closed The patient made an uncomplicated operative recovery.

ence with obstetrical palsy, says that electrical examinations are not advisable before the end of the second month, the use of an anæsthetic being essential, but by this time the case will probably show definite signs of recovery, so as to render electrical examination unnecessary. Sherren does not test the electrical reactions until the age of three months.³ The fact that, in most cases, there is practically no disturbance of sensation in the affected limb, although the roots of the brachial plexus are all mixed nerves, has not been satisfactorily explained.

The most substantial support of a plexus origin has been furnished, in about the last decade, by a few surgeons who have exposed the plexus in a small number of cases. In most of them the plexus was found enveloped in adhesions, in some the nerves were thickened and in a few one or more roots were found divided and the torn ends retracted. Only the last group, in my opinion, furnish substantial evidence in favor of the plexus theory, and even these need further confirmation. Without operation, it appears that the paralysis recovers spontaneously, in most cases, after a time, and time is not particularly important to these young patients. It has seemed to me that before the plexus should be exposed, definite areas of impaired sensation should be located. If these operations become common, there will probably be fewer complete recoveries of the paralyses than there are now. The operation was advised in one of my cases with posterior subluxation and was refused. That patient has been improving ever since and after about three years has recovered much power in the affected limb. In my opinion, the average surgeon without the facilities for careful study by dissection of the anatomy of this region, should not attempt to lay bare the delicate cord of the brachial plexus in the young child. The plexus is deeply situated in a confined region, surrounded by very important vessels and nerves, the cords of the plexus lying close together interweaving with each other and embedded in a mass of adhe-

³ *Injuries of Nerves and Their Treatment*, 1904, p. 259.

the shoulder In most cases the palsy is mild and transitory, in some it is very severe, but even in these it is probably rarely permanent Lange did not refer to the palsy in his adult cases but in his second paper, devoted to obstetrical palsies of the upper extremity, he ascribed most of these palsies to laceration of the capsule of the shoulder-joint Of his 17 palsied arms (in 15 patients), he regarded 13 as undoubtedly pseudopalsies, due to laceration of the capsule, and in 15 of the 17, he found the same position of the arm as in his "distortions" of the shoulder in adults According to Lange, Kustner believes that the obstetrical palsies are due to epiphyseal separations of the upper end of the humerus with rotatory deformity, while Finck believes that they are due to preglenoid dislocations of the shoulder

While the brachial plexus theory is generally accepted, particularly for the obstetrical palsies, there has been much discussion as to how the plexus is injured at birth and a variety of mechanisms have been suggested The greatest difficulty has been found in accounting for the localization of the injury to the junction of the fifth and sixth cervical roots of the plexus When a more or less general brachial paralysis follows soon after an injury to the shoulder region, the obvious cause is an injury to the brachial plexus The relation of an injury of the shoulder-joint to such a paralysis, is much less obvious It has seemed to me that the localization of the injury to the junction of the fifth and sixth cervical roots rested on an uncertain basis until supported by operations on the plexus Certain it is that in the great majority of cases, electrical examinations are not made to determine what muscles are paralyzed The diagnosis is, evidently, made upon the history of a paralyzed upper extremity, first observed immediately after birth, and upon the characteristic internal rotation of the whole limb Electrical examinations soon after birth are exceedingly unsatisfactory and unreliable and are rarely made Fairbank,² who recently reported probably the largest experi-

² Lancet, Lond, May 3, 1913, p 1217

Farmer. Examination June 16, 1913. Two months previous had sustained fracture of the lower third of the left tibia. There was slight anterior displacement of the lower fragment and non-union.

Operation.—On July 17, 1913, a transplantation was done from the same tibia to bridge the fracture which was comminuted. A letter from the patient dated December 11, 1913, states that he is walking with a cane. The convalescence was slow in this case, largely because of trauma at the time of the fracture. There was much swelling of the soft tissues, even two months after the fracture occurred.

CASE A97369.—Male, aged twenty-two. Chauffeur. Examined December 17, 1913. On November 25, 1911, he fractured lower third of right tibia and was treated by splints, casts, etc., until May, 1912, when an operation was performed. Bone transplant and silver wire were used. No union resulted.

Operation.—On December 23, 1913, in the Mayo Clinic a piece of bone 4 inches long was removed from the middle third of the tibia and used as a transplant to bridge the fracture. The wound healed by first intention.

sions Even in the hands of the able surgeons who have reported the results of their operations the proportion of cases showing divided nerve roots has been very small Fairbank operated on five cases and found rupture of the nerves in only one This involved the fifth and sixth cervical roots which were torn across at their junction Even in this case electrical stimulation before operation and of the nerves at operation, "made it certain that there must have been some fibrils passing on from the fifth cervical root or the fifth and sixth cervical to the bulbous common trunk (distal end of rupture), though dissection suggested complete division" Lange exposed the branches of the brachial plexus in the axilla in a case of obstetrical palsy, and found the cause of the paralysis to be the embedding of the nerves in thick connective tissue, for an extent of 4 cm, and found also a diminution and deformation of the head of the humerus This is the only case of obstetrical palsy, of which I have knowledge, in which the nerves have been exposed in the axilla where they are adjacent to the shoulder-joint I would suggest that the exudate and adhesions about the plexus, found so uniformly in operations above the clavicle, are the result of extension upward of the blood and synovial fluid from an injured shoulder-joint, which in the new-born is only a few inches below the plexus The almost recumbent position of the infant would favor this upward extension Boyer⁴ recently reported a very interesting case of obstetrical palsy in a woman who died in an insane asylum, and upon whom an autopsy showed clear evidence of tearing of the cervical roots, on the right side, from the spinal cord, the rupture affecting particularly the seventh cervical The brachial plexus of the left side appeared normal in size and origin The roots of the fifth, sixth, seventh and eighth cervical on the right side were much smaller than natural and were reduced to fibrous cords, which were impossible of good dissection owing to the abundance of tough fibrous tissue Boyer calls attention to the fact that the usual excision of a

⁴Proc Roy Soc Med (Neurological Section), 1912, p 31

worm-gut sutures. No evidence of infection on grafted side. At the end of four weeks patient was up and about on crutches. Recovery so far uneventful. February 10, 1913, walks about ward on his cast without pain. Bony union.

CASE II.—Patient, L. J., a German laborer, forty-seven years old, suffered a comminuted fracture of the left tibia and fibula, and a comminuted fracture of the left radius, as a result of a railway accident December 10, 1912. At the time of his admission to the Swedish Hospital it was noted that his body was covered with syphilitic rupia. This disappeared under mercury and large doses of potassium iodide in two weeks. An anæsthetic was given and his fractures reduced. A splint was applied to the forearm and a well-fitting plaster case to the leg. The arm united nicely. The leg, however, failed to show any evidence of bony union after eight weeks, and an operation was decided upon. This was performed January 28, 1913, at the City Hospital, under ether anæsthesia. A longitudinal incision seven inches long was made, just to the inner side of the crest of the tibia. The ends of the bone, while in good apposition, were not united but were covered with granulation tissue. A loose fragment, about one inch long, was detached from the posterior portion of the upper fragment. Owing to the great irregularity of the broken bone, the ends were cut off with a chain saw and the granulation tissue in the medullary cavity was reamed out for a distance of about two inches. The crest of the opposite tibia was now laid bare and a piece of bone about five inches long was removed. This was detached with the chisel after the crest had been cut to the required depth at either end with the saw. No attempt was made to remove the periosteum from the transplant. This was now immediately driven into the reamed out end of the lower fragment. Traction was made upon the leg and this large bone peg was inserted into the upper fragment and the bones brought into accurate apposition. A small nail was driven into the upper end in order to keep the transplant in place. The muscles and fascia were brought together with a few catgut sutures and the wound closed without drainage. The leg was put up in a plaster case. Primary union resulted. Six weeks later firm bony union had resulted.

CASE III.—H. E. C., General Hospital, carpenter, broke his tibia and fibula, about middle, by a fall from a scaffold. No union

rapidly that it is overlooked or ignored. Sometimes it is so severe and persistent that it cannot be ignored and then is usually ascribed to an injury of the brachial plexus. The best evidence that it is not due to an injury of the plexus is the fact that with the restoration of the normal motion to the shoulder-joint the palsy disappears rapidly. If the dislocation remains unreduced, the palsy will improve slowly, but will never entirely disappear because of the interference with the function of the joint, and perhaps also because of pressure of the dislocated head on the adjacent nerves. I have selected the following adult cases for illustration of different types of brachial paralysis of shoulder-joint origin.

CASE I—A woman, forty years of age, teacher of drawing. On May 13, 1913, on stepping from a row-boat which began to move away from the shore of a small lake, she grasped a post on the shore with her right hand, keeping both feet in the boat. The boat moved from the shore and dragged her feet until her body was almost horizontal and her right arm in full abduction, in which position she pulled the boat to shore again. She had some pain in the shoulder immediately but it was not particularly noticeable until about an hour later, and on the following day it was worse. On the third day Dr W. Drummond located severe tenderness over the greater tuberosity of the humerus. On the same evening he manipulated the shoulder to exclude the possibility of a dislocation, and during the manipulations observed a sensation as though the humeral head jumped out of the socket and back again, and felt distinct crepitus. The skiagraph taken on the fourth day seemed to show a fracture of the greater tuberosity, although this was not very clear. The arm was then bound in the Velpeau position, for 14 days, and on removing the bandage, the right arm hung helpless at her side and she could scarcely move a finger. This frightened her very much, because she had recently come from England to take a position as teacher of free-hand drawing, which required perfect movement of the arm. She was compelled to cancel her engagement and go back home. An insurance company, after the examination by its physician, quickly settled with the patient on a basis of five months' incapacity for work, indicating that the insurance physician regarded the

CHRONOLOGIC TABLE OF REPORTED CASES OF PNEUMOCOCCIC ARTHRITIS.—Continued.

No.	Reporter	Date	Age	Sex	Seat of arthritis	Relation of pneumonia	Nature	Complications	Treatment of joint	Functional result	Recovery or death	Remarks
40	McDonald ²⁸	1898	15	M	Hip	None	Suppurative	General sepsis	Arthrotomy	.....	D.	Suppurative joint following injury.
41	Osler ²⁹	1898	24	M	Knee	Pneumonia	Suppurative	Meningitis and double pneumo- nia; septicæmia	Arthrotomy	.....	D.	
42	Petitios	1898	42	M	L. knee	Pn. 5 days before	Suppurative	Meningitis	Arthrotomy	.....	D.	
43	Uckmar ³⁰	1898	A	M	Rt. shoulder	Pn. crisis 5 days before	Suppurative	.....	Aspiration and arthrotomy	Perfect	R.	
44	Widal and Laigné	1898	68	M	L. sternoclavicular	None	Suppurative	.....	Repeated aspirations	.....	R.	Chronic rheumatic.
45	Leroux ³¹	1899	45	M	L. wrist	Pn. 9 days before	Suppurative	Endocarditis; peritonitis; pleurisy;	?	.....	D.	
46	Preble ³²	1899	43	F	Knee, ankle, wrist and elbows	None	Suppurative	Suppurative meningitis	?	.....	D.	
47	Preble ³³	1899	33	M	Knee, elbow, wrist, and metacarpophalangeal	Pneumonia	?	Suppurative meningitis, general pneumococcus, bacteræmia	?	.....	D.	
48	Sorel ³⁴	1899	48	M	L. shoulder	Pn. 8 days before	Suppurative	Empyema	?	.....	D.	
49	Billings ³⁵	1900	23	M	Rt. shoulder, left knee, metatarsophalangeal	Pneumonia	Suppurative	.....	O	.....	D.	Injured left shoulder and knee one day before onset of arthritis. Old rheumatic.
50	Fernet and Lacapere ³⁶	1900	47	M	Rt. wrist	Pn. 3 days before	Serous	.....	?	Stiff joint	R.	
51	Lop and Bonus ³⁷	1900	28	F	Rt. wrist	Pn. 8 days later	Suppurative	Peritonitis; suppurative parotitis	Arthrotomy	.....	R.	Followed labor and peritonitis. Pneumococci in vaginal discharge.
52	Rendu ³⁸	1900	66	M	L. knee, l. sternoclavicular	Pn. 15 days before	Serous and suppurative	.....	Arthrotomy	.....	R.	

Scapulohumeral ankylosis. Cannot abduct arm to a right angle. Diagnosis Musculospinal and ulnar paralysis with total paralysis of hand. After seeing the case with Dr Lloyd, June 6-19, 1911, he asked me to treat it. On the following day I forced the arm into full abduction and external rotation, with the patient under ether, and fixed it in external rotation and almost full abduction on an obtuse angle splint, keeping the patient in bed. Although I cannot explain the rapidity with which the improvement developed, it was striking. On the following day, June 21, the little and ring fingers could be flexed slightly. June 22, could flex all the fingers slightly. With palm turned downward, could extend hand at wrist slightly. The ribbon-shaped ulnar area of anaesthesia had disappeared to such an extent that he could feel pain sense readily, although he still had numb sensations in this area. June 23, could flex and extend thumb fairly well and could flex fingers about one-fourth way toward making a fist. Motion at wrist also increasing. June 27, could grasp objects weakly with affected hand. Still had slight numb sensations along ulnar border of forearm. July 19, considerable atrophy of left arm and forearm. Sensation good in all parts of limb. Movement in left thumb almost as free as in right thumb, but power much less, and last phalanx could not be flexed as far as in right thumb. Could close fingers about three-fourths as well as on right side. Index finger did not flex quite as well as others. Could approximate thumb to all fingers except little finger. Could close fingers best with hand in dorsal flexion at wrist. Could flex and extend wrist almost as well as on right side, either with palm turned upward or downward. Rotation of forearm about as free on left as right side, although the power was much less. Active flexion and extension of elbow almost as free on left as right side but muscles much weaker. Active abduction at the shoulder to about 100 degrees, passive abduction to about 160 degrees.

The patient returned to work August 28, his work consisting chiefly in chipping iron and steel with a hammer and chisel, the latter being held in the affected hand. At first he had much difficulty in holding the chisel firmly enough, and could not have continued at his work if the foreman had not encouraged him to do so. In about two weeks he could do his work satisfactorily enough. The improvement in the whole limb continued, until in about a

No.	Author	Year	Age	Sex	Site	Duration	Condition	Pathology	Operation	Result	Remarks
53	Agathos ¹	1901	60	M	L. sternoclavicular	Pneumonia	Suppurative		Arthrotomy	R.	
54	Agathos ²	1901	63	M	L. wrist	Pn. 10 days before	Suppurative	Empyema, pericarditis	Arthrotomy	R.	
55	Allen and Lull ¹	1901	40	F	L. knee	None	Suppurative		Arthrotomy, amputation	D.	Primary case.
56	Anzilotti ¹	1901	50	M	L. knee	Pneumonia	Suppurative	Acute nephritis, meningitis, decubital abscess	Arthrotomy	D.	
57	Cave ¹	1901	51	M	L. shoulder	Pn. 9 days before	Suppurative		O	D.	Injury to shoulder.
58	Lannois and Paris ¹	1901	46	M	Rt. wrist	Followed pn.	?	Endocarditis	?	D.	
59	Rawlin ¹	1901	28	M	Rt. sternoclavicular	Pn. 3 days before	Suppurative	Rt. otitis media, abscess of thigh	Arthrotomy	R.	
60	Rawlin	1901	52	M	Rt. ankle	Pn. 2 days before	Suppurative	Rt. empyema	Arthrotomy	R.	Old rheumatism.
61	Rawlin	1901	49	F	Rt. shoulder	Pn. 2 days before	Suppurative	Rt. empyema; cellulitis	Arthrotomy	D.	Alcoholic.
62	Rawlin	1901	23	M	Rt. knee	Pn. 2 days before	Serous		Aspiration	R.	Useful joint.
63	Rawlin	1901	51	M	Both knees	Pn. 6 days before	Serous	Severe toxemia; generalized infection	Aspiration	D.	Alcoholic.
64	Rawlin	1901	58	M	Rt. knee	Pn. 3 days before	Suppurative	Arthrotomy	Arthrotomy	R.	Self joint, but useful.
65	Rawlin	1901	42	M	Rt. shoulder	Pneumonia	Suppurative	Severe general infection	O	D.	
66	Barnard ¹	1902	14	M	Rt. knee	None	Suppurative		Arthrotomy	R.	Followed influenza.
67	Bichat and Goeptert ¹	1902	8 mo.	F	Rt. knee	Broncho-pn.	Suppurative		Arthrotomy	R.	
68	Bichat and Goeptert ²	1902	11 mo.	F	Rt. knee	Broncho-pn.	Suppurative	Meningitis	Exploratory puncture	?	Left hospital against advice.
69	Cole ¹	1902	50	M	Ankle	Pn. 12 days before	Suppurative	Endocarditis	Aspiration, arthrotomy	R.	Leucocytes 15,000.
70	Cole ²	1902	55	M	Both knees and ankles	Pn. later	Suppurative	Septicemia and meningitis		D.	Old arthritis deformans.
71	Gaillard ¹	1902	63	M	Rt. knee	Pneumonia	Suppurative	Endocarditis	Aspiration	D.	Chronic alcoholic.
72	Giltay ¹	1902	31	M	Rt. knee	Pneumonia	Suppurative	In extremis	Aspiration, amputation	D.	
73	Hektoen ¹	1902	47	M	L. knee	Pneumonia	Suppurative		Aspiration	D.	Alcoholic.
74	Herrick ¹	1902	32	M	L. elbow	Pn. 7 days before	Suppurative		Aspiration	R.	
75	Herrick ²	1902	41	M	L. knee	Pn. 2 weeks before	Serous	Dry pericarditis	Repeated aspirations	R.	Alcoholic. Injured knee one month previously.
76	Herrick ³	1902	26	M	Rt. knee	Pn. crisis 8 days before	Suppurative	Pericarditis. Severe toxemia	Arthrotomy	D.	

ing motion She returned in October asking for the operation, which was performed at the Howard Hospital, November 14, 1912 The arm was fixed at a right angle on a splint for three weeks Soon afterward she began mechanical treatment in the orthopaedic gymnasium of the University Hospital, for which privilege I am indebted to Professor G G Davis This treatment was continued until June, 1913, when she left for her summer vacation She could then raise her arm straight above her head, by anterior elevation but could not raise it as far by lateral elevation The improvement in power was general in the whole limb and was still continuing She could play on the piano, could swing light Indian clubs, and do many other things that she had not been able to do since before the axillary abscess had developed

As I view this case, the axillary abscess resulted in essentially the same condition as the shoulder-joint injury in the preceding cases, except that in this one the involvement of the branches of the brachial plexus in the scar tissue produced a more severe and unyielding condition than is usual after the joint injury The release of the nerves from this dense scar tissue must be a slow process How much return of power will ultimately occur, remains to be seen

Posterior subluxations of the shoulder-joint associated with obstetrical palsies are only now beginning to receive the attention they deserve Fairbank says, "Anatomically, there is no doubt about the subluxation" He has notes of 40 cases of obstetrical palsy seen during the last few years, 35 of them in the "last three years or so," and of the subluxation he says it "has received little or no attention in this country" (England) Excluding three of his 40 cases, seen before the subluxations were appreciated, 28 of the remaining 37, or 76 per cent, showed subluxation of varying degree Nine out of my 12 cases, or 75 per cent, showed subluxation That they have received little attention is to be accounted for by the fact that they are peculiarly obscure (see Figs 1, 2 and 3) I had never had any particular interest in obstetrical palsies until I realized that they were generally supposed to be due to the same cause as the

To prove this the essential thing is to show that the dislocation occurs at birth and is traumatic in origin. While it is possible to have a dislocation and a rupture of the brachial plexus occur at the same time, this is not likely or, at least, is not likely to be frequent. We have no positive evidence that the subluxations are due to paralysis. Stimson, like Whitman, included under congenital dislocations of the shoulder, all dislocations present at birth or developing as the result of injury to the brachial plexus, and, like Whitman, regarded the true congenital dislocations as rare. But while Whitman considered those secondary to an injury to the brachial plexus, as the most frequent, Stimson⁷ thought it probable that the most frequent variety was due to force applied to the shoulder at birth. He had 5 cases, all backward dislocations; four of them, possibly all, occurred at birth. Both Whitman and Fairbank say that the shoulder-joint is injured at birth in some cases, and Fairbank states that it would be impossible to say that the dislocation did not occur, in some cases, coincidently with the plexus injury at birth. In one of his cases, the physician who was present at the birth of the patient, diagnosed the dislocation of the shoulder at that time, but Fairbank concluded that the physician must have been mistaken. In 5 of his 28 cases with subluxation, he completely reduced the dislocation without operation. The earliest period at which he has seen a reducible subluxation was 2 months. The dislocation in this case had probably existed some time previous to the reduction, which brings its origin close to birth. Of the 28 cases, 14 were in the first year of life. In 18 of the 28, electrical examination, under an anæsthetic, showed no signs of paralysis. Of the 10 remaining, 7 showed only some weakness of the extensors of the back of the hand. It will be seen, therefore, that in at least four of his cases, the paralysis had entirely disappeared within the first year of life, and in 11 it had almost entirely disappeared. A paralysis which disappeared so soon, could hardly be expected to produce, secondarily, a subluxation of the shoulder that would be irreducible without operation.

⁷ Fractures and Dislocations, 1907, p. 610

I have had only nine cases of obstetrical palsy with subluxation which, I confess, is a small experience upon which to base a dispute concerning the obscure etiology of these cases. I believe, however, that there is in every one of these nine shoulders positive evidence that the subluxations developed at birth from direct pressure against the anterior portion of the shoulder pushing the humeral head backward. It should be borne in mind that these subluxations have been, practically, overlooked until recently. Close observations of them have not yet been reported. In my second case the subluxation was easily recognized although it was of milder grade than in the first, but as in the first I was conscious of the fact that there was something peculiar in the conformation of the shoulder which I did not understand. I was imbued with the idea that all that was necessary was to reduce the dislocation and from my operative experience in the first case, I was convinced that the chief obstacle was connected with the alteration in the glenoid cavity and with the anterior portion of the capsule. I met these conditions in operation on this second case by dividing completely the anterior portion of the capsule and removing the upper anterior margin of the glenoid cavity. Although I restored much of the restricted abduction and external rotation, and the function and development later improved remarkably, I did not completely reduce the dislocation. This became more obvious in the after-treatment when I could palpate the shoulder freely without pain to the patient, and it was then that I discovered what I believe will throw a new light on the subject of obstetrical palsy. If the examining finger is passed from behind over the upper surface of the acromion, on the normal side, it will come upon the rounded upper end of the humerus just in front of the anterior edge of the acromion. By the same manœuvre on the affected side, the finger will not find the smoothly rounded upper end of the humerus, just in front of the acromion. What I had not recognized before was that the anterior portion of the acromion was bent downward and as the finger passed forward it continued in contact with this portion of the acromion a slight distance

downward (see Fig 1a (*A*), and Fig 4 (*A*)). This change in the shape of the acromion was present in varying degree in all nine of my cases with posterior subluxation.

My only purpose at present is to call attention to its presence and to its probable significance. I am not prepared to describe the deformity in detail because its characteristics vary. This is probably due to the fact that the pressure which is responsible for it is not always applied exactly in the same place. The most important variation was found in my last case, in which the posterior dislocation was more marked than usual. The downward projection of the anterior portion of the acromion was slight or absent and merely changed the normal inclination of the acromion from the anterior margin downward and backward, so that it was horizontal or slightly curved from before backward, which showed that the anterior portion had sustained pressure from above. In this case, however, there is evidence that the coracoid process had received considerable pressure. Efforts to show the deformity by the X-ray have not been satisfactory (see Figs 5, 6, and 7).^{*} This may be due in some cases to the fact that the abnormal portion of the acromion is cartilaginous as shown by operation in two cases, and in others to the difficulty in bringing out by the X-ray the difference between the normal inclination of the acromion and the change produced by the pressure. As one would expect

^{*} The downward projection of the acromion which is easily palpable and even visible in Case I—Fig 1a (*A*) and Fig 4 (*A*)—is not shown in the skiagraph (Fig 5, right shoulder). In Case II it is easily palpable and its borders can be outlined, yet it scarcely shows in the skiagraph, Fig 6 (right shoulder). In Case VIII it was not present although the acromion seemed depressed as a whole and was more horizontal than on the normal side. There is shown in all three cases, by the X-ray, a change in the plane of the acromion. On the normal side it is seen as a thick plate of bone, due to its inclination downward and backward from its anterior to its posterior border. On the affected side, in all three cases, it appears to be thinner, indicating that it occupies a more horizontal plane, which is to be explained by a downward pressure on the higher anterior portion, during birth. Figure 5, right shoulder, seems to show that the humeral head and acromion have been largely worn away, by rubbing against each other during movement. In the normal or left shoulders, the lower margin of the shadow of the acromion marks the posterior margin. This is not so

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110

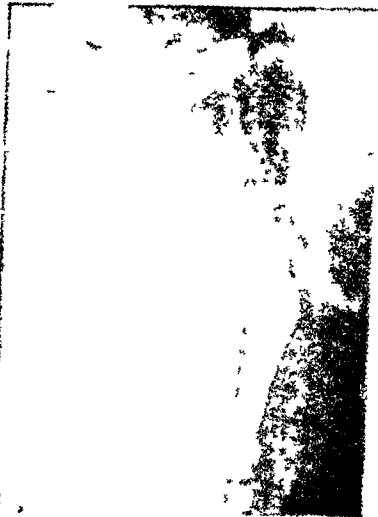


Case I Comparison between the two shoulders disclose a flatness anteriorly in the right one. The turning downward of the acromion is faintly discernible at A. In the other cases careful palpation was necessary to detect it. In this case there is a bony protuberance at the acromioclavicular joint which accounts for the diagnosis of fracture of the clavicle at birth.

A

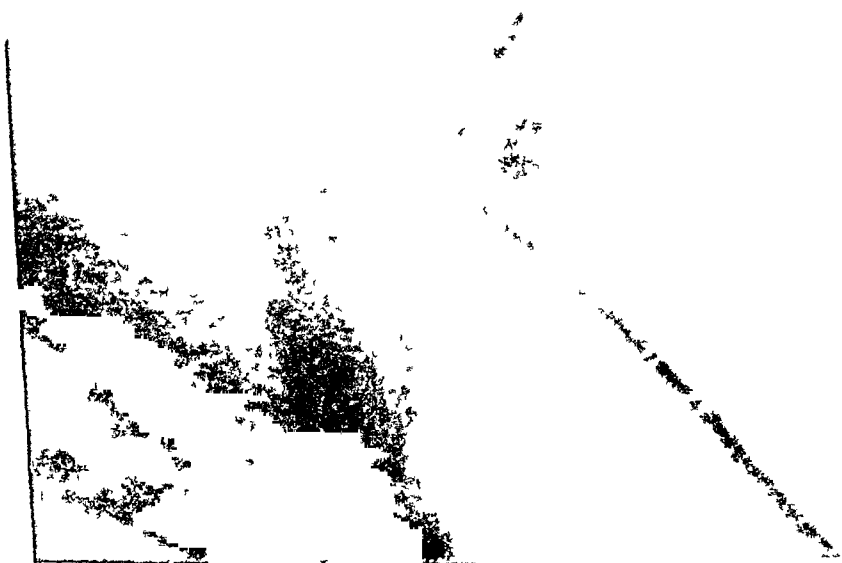


FIG 2



FIG





Case I Left shoulder.



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Cure VIII Right shoulder



Case II R_1^{-1}

$\frac{1}{2}$ 1

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terior surface so as to swing it up in normal position (procedure of Webster). The patient made a smooth operative recovery and when discharged was greatly improved both in her mental and physical state

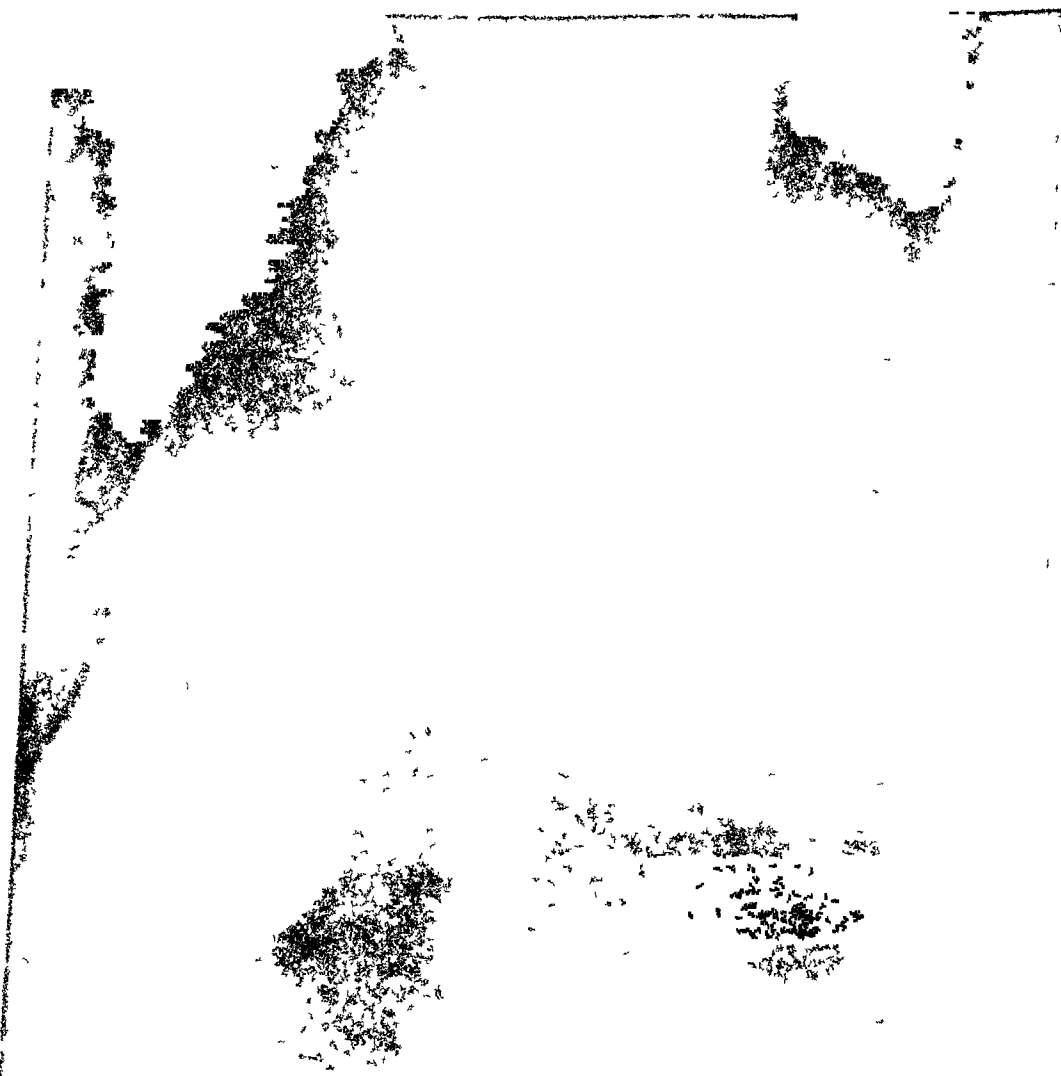
CASE XIV—*Proximal portion of transverse colon bound to ascending colon by dense membranous cover (double-barrelled shotgun arrangement), appendix chronically inflamed, gall-bladder inflamed and filled with calculi, liver prolapsed, stomach dilated and prolapsed, duodenum dilated and prolapsed* (St John's Hospital, Service of P. M. P.)

A woman, forty-four years of age, was admitted for relief of constipation and pain in the upper abdomen. During her whole life she had suffered from constipation and had always been afflicted with stomach troubles. Eighteen months before admission she suffered an attack of intense pain in the region of the gall-bladder, on account of which she was kept in bed several days. Later she had suffered regularly from pain in the epigastrium, starting about two hours after eating, which would be relieved by taking food. The constipation increased in degree and was attended with much flatulent pain. When examined the upper right rectus was tense and the stomach was dilated, no point of tenderness was elicited.

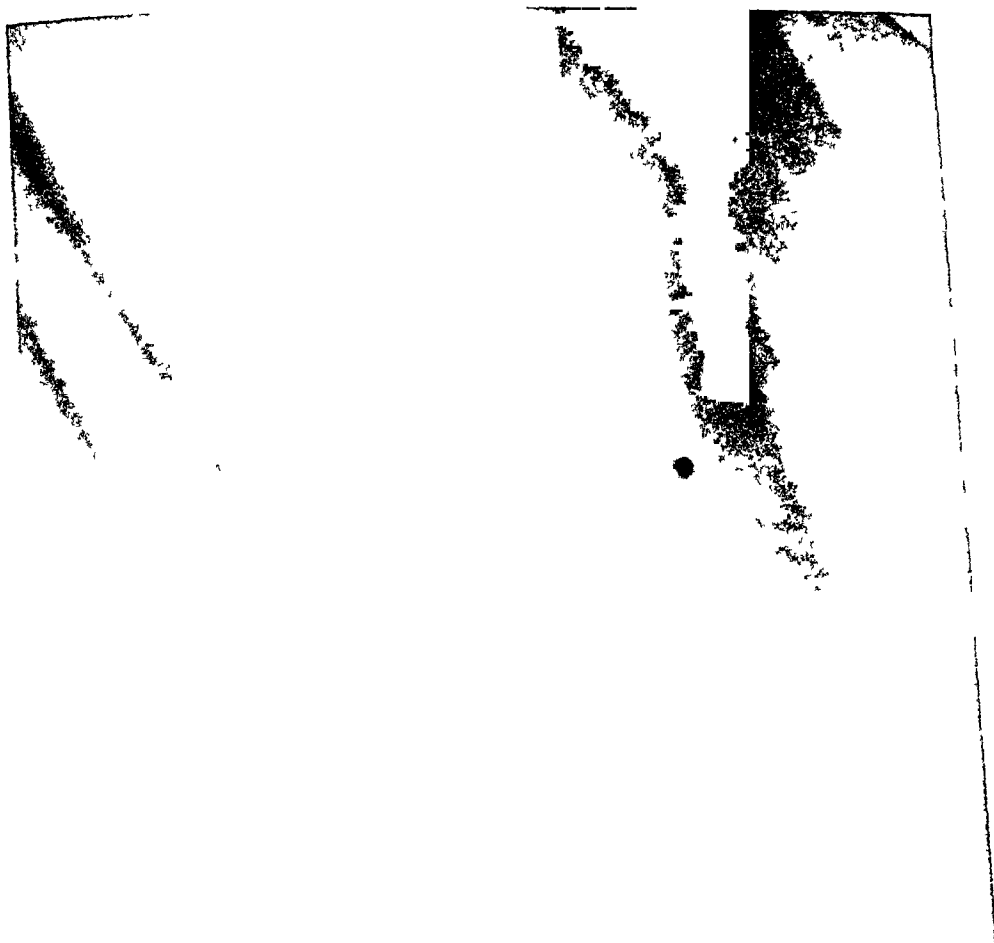
When the abdomen was opened the ascending colon and adjacent portion of the transverse colon were found bound down and covered over by a dense membranous veil, a typical membranous pericolicitis. This veil was divided and reflected, freeing the colon and cæcum. The appendix when brought into view was found chronically inflamed and distended by fæcoliths. It was removed. The stomach was prolapsed and the duodenum was dilated two or three times its natural size. The liver was prolapsed, the gall-bladder was the subject of chronic inflammation and contained 16 calculi. The anterior edge of the liver was sutured to the anterior abdominal wall. Tube drainage of the gall-bladder was established and the wound closed about the drainage tube.

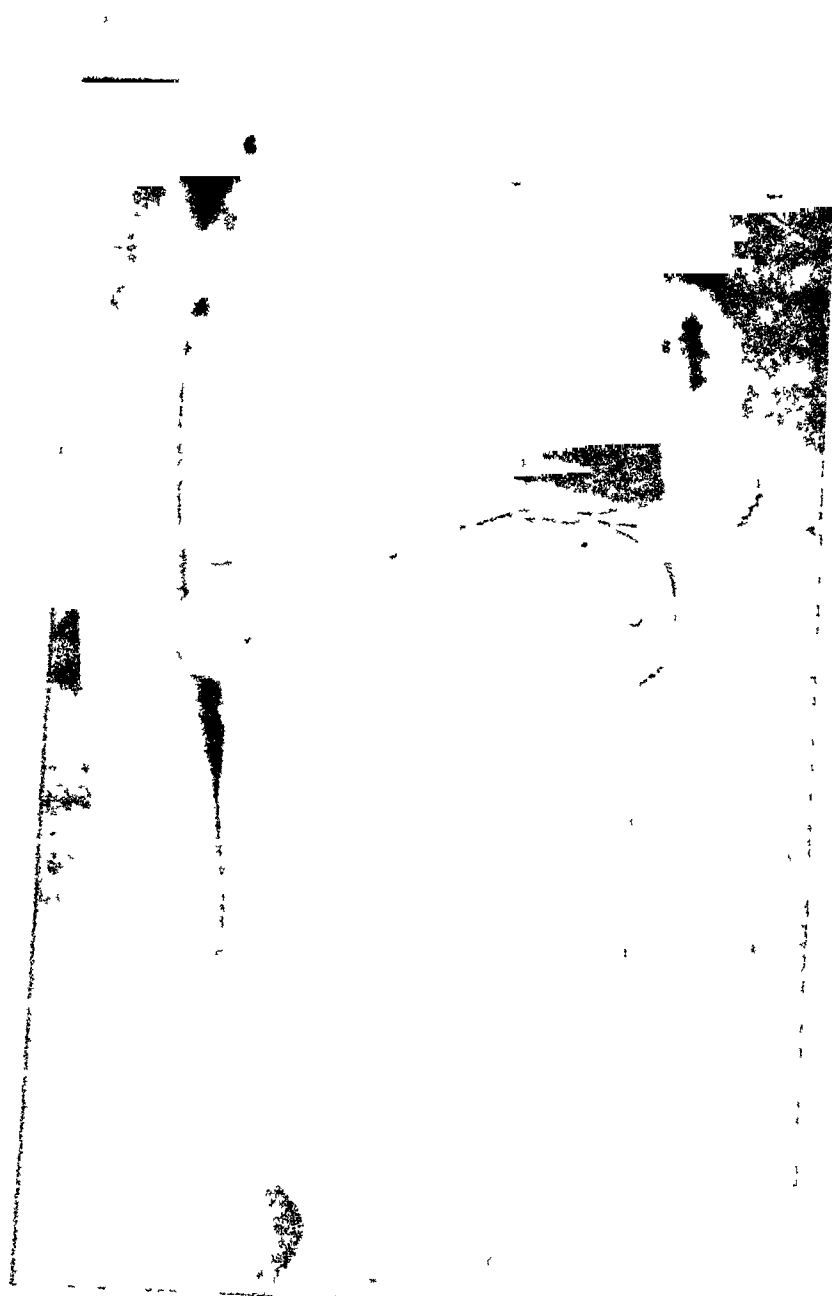
Subsequent recovery uncomplicated. Tube removed at end of twelve days.

In this case it was observed that the under surface of the ascending and transverse colon was perfectly normal, free from adhesions of any kind. The presence of the membranous for-



Case VIII Right shoulder





16 10

Figs 8 and 9 show degree of active elevation of arm. Mechanical obstruction and not lack of power prevents greater elevation. Patient shown in Fig 8 has the better development and use of the limb



Fig 8

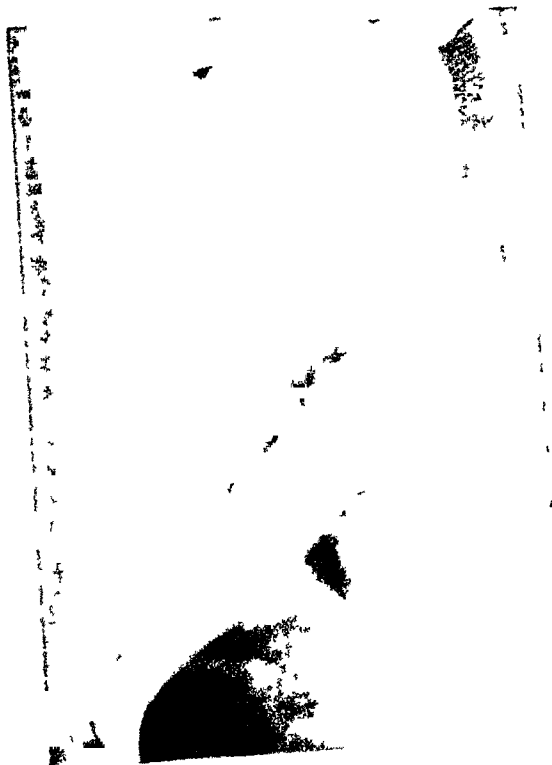


Fig 9



Case 1

FIGS 12-11—12-12—Three different positions in which the limb was dressed after operation



Case VIII



Case VI Shows limitation of extension at the right elbow which is about the same in Case IV and in one case without subluxation of the shoulder Comparison with the other arm shows the internal rotation

from the fact that the deformity has been overlooked, it is an obscure one. A careful examination is necessary to establish its presence and outlines. The downward projection of the acromion seems almost to fuse with the upper end of the humerus and it is a little difficult to determine when the examining finger is on this portion of the acromion and when on the humerus. It is most evident in the older patients and in them seems to be ossified.

The explanation for it seems obvious. For my cases, at least, it offers positive evidence for what Stimson had already suggested, *i e*, that most of the congenital dislocations of the shoulder are probably the result of direct pressure backward on the humeral head by the bony wall of the maternal pelvis, during birth. He says that some of the paralytic forms have been described as "obstetrical paralyses." He also says "In my four cases, Scudder's two, and Cumston's, the right arm was affected, in Gaillard's the left, and it seemed possible that as the right shoulder is in front in the great majority of births, the cause might be its pressure against the arch of the pubis. Against this or, at least, limiting it, is the double dislocation in Kustner's and the breech presentation in one of mine." My cases furnish a striking confirmation of Stimson's observation. In 11 out of my 12 obstetrical palsies, the right arm is involved

certain on the affected side. If on this side the lower margin in the skiagraph represented the anterior border, it would seem that this has been bent downward.

A mild downward displacement of the humerus is shown in the three cases. The posterior displacement cannot be shown by this exposure and only with difficulty by any other. Note the absence of the separation between the clavicle and acromion on the affected side (the normal shoulder) seems to show complete fusion of the two bones. The bony protuberance at the site of this joint in this picture. The lower end of the two bones seems to be shown in figure 1. The lower end of the clavicle can be faintly traced indicating that the joint is not present in this case. The X-ray shows clearly that the epiphyses of the humerus are separated. The small size of the humeral head of the affected shoulder of Case VIII (fig. 2) is due to the fact that the humeral head (fig. 2) is displaced backward and upward, and atrophy of the muscles (fig. 12, 13).



Case VIII Atrophy of whole limb marked of shoulder and arm muscles more marked than in any of the other cases. The higher of the two prominences seen anteriorly is the edge of the acromion the lower the coricoid process

mation on the anterior surface of the intestine only might suggest a doubt as to whether it was originally caused by infection from the intestine

Since this operation to the present time the patient has been able to eat anything in moderation, without any gastric or intestinal distress Her bowels move naturally

CASE XV —*Cæcum confined by broad membranous veil, thickened to form dense band covering appendix and inserted into terminal ileum, forming pronounced ileac kink, appendix chronically inflamed, healed duodenal ulcer, with abundant adhesions between duodenum and gall-bladder* (Hospital No 394)

A man forty years of age In childhood was troubled with spells of repeated vomiting and attacks of so-called indigestion Between the ages of twelve and twenty-five there were occasional spells of indigestion, followed by longer intervals of comfort Twelve years ago began to suffer, especially after periods of much mental effort and concentration, from attacks of pain in the epigastric region These would last from a few days to several weeks The persistence of these attacks have greatly diminished his ability to discharge the duties of his avocation, which is such as to frequently demand great mental and physical exertion Is subject to habitual constipation Abdominal palpation elicits pain and tenderness in the epigastrium, otherwise negative Test meals show hyperacidity which, however, is not always present Examination of stool gives strong test for blood X-ray examination indicates attachment of pylorus to the gall-bladder and liver

Abdomen was opened through the right rectus muscle by incision extending from the free border of the ribs to $1\frac{1}{2}$ inches below the umbilicus The omentum was adherent to the anterior abdominal wall After this had been separated and the colon exposed, the cæcum was found held down by broad thin bands typical of membranous pericolicitis The appendix was covered in by a strong band of adhesions which passed from the lateral parietal wall of the iliac fossa over the appendix and was inserted into the ileum $1\frac{1}{2}$ inches from the ileocæcal junction This band held the ileum down and markedly angulated it The appendix was also angulated, its tip adherent to the small intestine and the omentum The appendix was in a condition of chronic inflammation The adhesion bands were divided and reflected and the appendix removed

Fairbank, however, says of his cases that "The two arms were affected in an equal number of cases."

The dislocations of the shoulder in the adult are almost always anterior, those associated with obstetrical palsy are practically always posterior. The only autopsy report on a congenital dislocation of the shoulder, found by Stimson, was of a double anterior dislocation reported by R. W. Smith.⁹ After reading Smith's paper, published in 1847, I would agree with Stimson that in all probability this was not a case of congenital dislocation. In my opinion, the great majority of dislocations of the shoulder in adults are anterior because they are due to hyperabduction, which can produce only an anterior dislocation. The few posterior dislocations that do occur in adults, are probably due to direct violence pushing the humeral head backward. The fact that practically all dislocations of the shoulder occurring at birth are posterior, is probably to be accounted for by the same mechanism, as the child is coming through the birth canal. Lange, in discussing Finck's idea of a preglenoid dislocation in these cases, maintained that a dislocation of the shoulder, to occur at all, must be complete, and that such a dislocation in the new-born could be shown by the X-ray. Neither Finck, nor any other writer, he says, has established in this way, a dislocation of the shoulder in the new-born. He adds that the application of strong force during birth would result rather in an epiphyseal separation than in a dislocation. There would be much force in these statements, if we ignored the fact that all dislocations are not produced in the same way, and this fact has not received much attention. The anterior dislocations are the result of indirect violence exerted through hyperabduction of the humerus and the first strain at the shoulder comes on the axillary portion of the capsule which must tear before a dislocation can take place. I have tried in several infant cadavers to produce an anterior dislocation by hyperabduction and have obtained each time an epiphyseal separation or a fracture of the upper end

⁹ Fractures and Dislocations, 1847

together with the presence of an abnormal prominence just below and behind the posterior margin of the acromion. The degree of displacement varies considerably in my cases, although in none is the dislocation complete. The amount of fat and the mild grade of displacement, may make the conformation of the shoulder so nearly normal that the subluxation will be overlooked unless one has in mind the possibility of its presence and makes a careful examination. I overlooked it in two of my early cases.

If a dislocation of the shoulder in the adult produces a brachial paralysis without rupture of nerve fibres, a dislocation in the new-born is much more likely to do so because of the much more delicate and sensitive muscles and nerves. This will account, I believe, for an interesting difference between the two groups of cases. In the new-born the paralysis seems to be complete in most or all cases for a time. In the adults, it is rarely complete. In both there is usually a tendency to rapid improvement. In a case, without dislocation, seen with Dr. L. C. Peter, about six weeks after birth, the palsy had almost entirely disappeared, yet immediately after birth the palsy was complete, according to the statement of Dr. Peter, who is a neurologist of experience. It is generally agreed that in the majority of cases, the paralysis spontaneously recovers. Reports of cases in which the extent of the paralysis is made evident by electrical examination, are conspicuous by their infrequency, and in this respect they are very similar to the adult brachial palsies from injury to the shoulder region. Fairbank found that in most cases the paralysis had largely disappeared by the end of the second month, as determined by electricity. In his series of 40 cases, the nerves appeared to have completely recovered or showed every sign of recovering at the time of his report in, at least, 60 per cent of the cases. In several of the remaining 40 per cent, the residual paralysis affected one or more muscles of the forearm only, the bulk of the paralysis having entirely disappeared. It should be borne in mind that 14 of his 28 subluxation cases were in the first year of life, how many of the other 12 cases without subluxation he does not say. The

normal. The infective process diminished, the temperature fell to normal and the wounds under daily dressing healed slowly, the sloughs separating and granulations of a healthy character soon closing the wounds. At the end of a month the urine was free from sugar, acetone and diacetic acid, and the patient left the hospital with wounds healed, having escaped amputation and with his diabetes much improved. He continued on a strict diet; his diabetes was held in check until he died of cerebral apoplexy eighteen months later.

CASE II.—A Jewish woman, fifty-one years old, whom one of us (Dr. Foster) had seen several times in consultation. She loved food and especially sweets, detested dietetic restrictions and pretty well ignored her medical advisers. In June, 1912, an acute inflammation of one of the great toes appeared. The slight swelling, redness, and heat in this location, together with the pain, at first suggested gout. After a week, however, the color began to change to a livid hue which later became purplish. The increased heat disappeared and the toe grew colder than the others up to midtarsal joint, and insensitive to touch, although still somewhat painful. There was evidence of marked arteriosclerosis of the radial arteries. The condition was pronounced gangrene and operation advised. The diet had been largely of carbohydrates during the time when the gout theory of causation was entertained and the urine averaged about 200 grammes of sugar *per diem*, there was, however, no evidence of acidosis. It was determined to give diet a trial before proceeding to radical measures, and a competent nurse was put in charge. A strict dietary was carried out for three weeks before the urine was rendered sugar free. During this time the toes did not notably change either for better or worse; but after the urine had been sugar free about a week, the color of the toes began to fade, becoming white and finally normal flesh color. At the same time sensation and warmth slowly returned until a complete recovery was made. This patient remains well although the diet is only an awful memory and the urine contains sugar.

CASE III.—A man fifty-two years old, was admitted to the service of Dr. Joseph A. Blake at the Presbyterian Hospital, with the following history:

The patient remembers no illness prior to one year ago when he had a small blood blister on the fifth toe of his left foot. This

shoulder was probably traumatic (and not secondary to paralysis), "that the limitations of motion closely resemble those of the similar traumatic dislocations in adults" As I see these cases of obstetrical palsy with posterior sublucation at eight to ten years of age, especially the two which were in- completely reduced about two years ago, they are nothing more than old unreduced dislocations of the shoulder. Such limitation of movement and power as is present, is to be explained by the displacement in the shoulder-joint Both Whitman and Fairbank believe that sometimes the displacement in the joint is the only obstacle to complete recovery I believe that this is true of practically all early cases In long standing cases, permanent changes have taken place, particularly, in the bones, and in some cases there is a marked lack of growth in the limb Reduction of the dislocation will improve these very much, but of course will not restore the limb to the normal It cannot be expected to restore the normal shape of the humeral head and glenoid cavity, although these may improve from long continued movement with the bones in normal contact with each other While the affected limb may be shorter than the other and atrophied, we may expect improvement in size and strength This has resulted already in my second case operated on, to a very satisfactory degree, and in the first case, the improvement is almost as satisfactory (see Figs 8 and 9) It is of interest that the displacement in the first is more marked than in the second

In one of my cases there was the usual posterior sublucation of the shoulder with the bent down condition of the acromion, and in addition an anterior dislocation of the head of the radius (see Fig 10) Fairbank had a similar case and thought the radial dislocation congenital in origin I prefer to believe that, like the shoulder dislocation, it occurred at birth and is traumatic in origin Electrical examination by Dr J W. McConnell, did not reveal that any muscle was completely paralyzed, but while the muscles of the arm from the shoulder to the elbow showed the same atrophy and weakness as in the other cases of sublucation of the shoulder at about the same

Fig. 3



Case III. Note calcification of dorsalis pedis artery, marked periostitis of third and fourth metatarsals, and osteomyelitis of fourth metatarsal and phalanges of fourth toe.

skeleton, like fractures of the clavicle and humerus, both of which were present in one of my cases, receive attention, but the less obvious injuries, especially those of the shoulder-joint, have been largely overlooked. In any case I would look first to the shoulder. If this were the general teaching and practice, I believe that there would be much fewer permanent obstetrical palsies. If there was present a subluxation of the shoulder and the physician in attendance at birth had this possibility in mind, he would probably find it in most cases and would probably reduce it immediately. The palsy would then gradually disappear, although this might require months or years. If the dislocation is first recognized months or years after birth, the first consideration should be to reduce it. But while the condition has received little attention as yet, the work of Whitman and Fairbank show that the subluxation is very difficult of reduction. Of his 28 cases, Fairbank could reduce only five without operation. Whitman, who used the non-operative method of reduction, found that in the more extreme cases it is impracticable to complete the reduction at one sitting. He applied a plaster case after the first attempt and undertook the further correction after an interval of two weeks. In all the cases, he says, there is a strong tendency to return in some degree to the original posture. I have had, as yet, the opportunity of attempting reduction in only five of my nine cases with subluxation. In my first and second I failed to reduce completely by operation. In the third, I tried the Whitman non-operative method of reduction after exposing and removing the obstructing portion of the acromion, and accomplished complete reduction rather easily. But soon after the removal of the case the subluxation recurred and the limb took the position of internal rotation again. It could easily be reduced again by rotating the arm externally. I attribute this result to the fact that the posterior part of the capsule was made longer than normal by the subluxation and was not shortened after the reduction. The abnormal changes in the humeral head and glenoid cavity from the ten months' duration of the dislocation, probably favored the gliding of the head into the dislo-

was calcification of the dorsalis pedis artery, plainly shown as a shadow between the first and second metatarsal bones.

The urine on admission was: total quantity, 1515 c.c.; sugar 3 per cent.; glucose 45.45 grammes; acetone moderate reaction; diacetic acid, faint trace; total nitrogen 12.41 grammes; ammonia nitrogen 0.89 grammes. The kidneys excreted 64 per cent. of phenolsulphonthalin in two hours. Although amputation of the foot seemed to be the only thing to do, it was determined to delay as it would not increase the danger to the patient and a trial of suitable diet was advised.

This patient had practically no ability to utilize any carbohydrate; and ingest of gms. 20 of starch was followed by the excretion of gms. 19.8 of sugar and it required three weeks before a sugar-free urine was secured. In this interval, however, the assimilation limit had been raised appreciably as was evidenced by the excretion of from 3 to 6 grammes of sugar after ingesting 20 grammes of starch. At first there was no evident improvement in the foot, but after two weeks a rather sudden turn for the better occurred and this was coincident with a marked return of the patient's strength and well being. Large pieces of plantar fascia came away as sloughs, the circulation in the foot improved slowly and the sinuses became lined with healthy granulations which subsequently healed, and at present he is walking about and reports that he feels "perfectly well." The urine now remains sugar free, although the present diet contains 160 grammes of starch.

The conditions illustrated by these cases raise an interesting pathological question. In the proper meaning of the term this morbid process is not a gangrene; that is not conceivable in the light of ultimate restoration to normal, and yet the condition cannot be differentiated from some cases of gangrene, as there is present a stasis of the circulation which is almost complete.

Many theories have been advanced as to the nature of the process and its underlying causes. There seem to be several factors, all or any combination of which may be present in a given case. There is, we believe, an infection with micro-organisms in every case and there is no specific organism but the common pathogenic forms. In addition to this there may

carry the hand higher and had nearly full external rotation. Case IX with a mild subluxation has recovered almost a normal arm from exercises alone, without reduction of the subluxation. Osteotomy does not improve motion of the arm, which can only be done at the joint, but merely improves external rotation at the expense of internal rotation. It should be borne in mind that Lange attributes the limitation of movement at the shoulder, to an epiphyscal separation of the upper end of the humerus, in these obstinate cases. I have no doubt that the existence of subluxation in these cases, will become generally recognized, when it will become obvious that the best place to improve the movement of the arm, is at the shoulder-joint and not at the middle of the humerus.

Conclusions —In the great majority of cases of obstetrical palsy of the upper extremity, the primary cause is not rupture of the brachial plexus but an injury to the shoulder-joint, the plexus and its branches becoming involved in the adjacent axillary inflammation. Electrical examinations will fail in most cases to demonstrate actual nerve paralysis after two or three months and before that time they are not advisable (Fairbank and Sherren). Detailed reports showing accurately the extent of the nerve paralysis by electrical examination, are conspicuous by their infrequency.

In most of the cases in which the brachial plexus has been exposed by operation above the clavicle, rupture of the plexus has been assumed because of the presence of adhesions about the plexus and thickening of the cords. The very few cases in which the roots have been found ruptured, need further confirmation because of their very small number and because of the great difficulty in dissecting accurately the delicate and interweaving roots. Fairbank, evidently, experienced this difficulty and Boyer, in an autopsy, found the plexus impossible of good dissection because of the abundance of tough adhesions. The presence of these adhesions is best explained, in my opinion, by the extension a few inches upward of the

First, with regard to those patients who present no evidence of acidosis, the urine gives no reaction with ferric chloride (Gerhardt's test). These cases may be divided for our convenience into classes: (1) Where the urine becomes sugar free quite promptly after restriction in carbohydrate; (2) where the urinary sugar falls to trifling amounts, 1 to 5 grammes per day, on restriction of starch, but fails to disappear completely on this diet. In both of these classes, without evidence of ketonuria, the diet may be reduced at once to very small amounts of carbohydrate by using meats, eggs, fats, and vegetables that contain little starch. The foods that are available for this diet make up Table I.

TABLE I.

Breakfast¹: Eggs, chops, broiled chicken, fish (fresh, salt or smoked), ham, bacon; tomatoes, onions, mushrooms (broiled or fried); coffee, 1 tablespoonful cream, saccharine to sweeten.

Lunch: Clear meat broths, meat of all kinds, game, poultry, fish; green vegetables, served hot with butter sauce, spinach, Brussels sprouts, string beans, asparagus, artichokes; salad of lettuce, endive, cucumber or tomatoes, with oil and vinegar, and any kind of cheese.

Dinner²: Clear broths, *e.g.*, consommé; meats same as lunch; artichoke root as substitute for potato, cabbage, asparagus, spinach, string beans, served hot; gelatine jellies and custards sweetened with saccharine; nuts of any sort, except chestnuts. Black coffee (claret or whiskey, if desired).

In addition to these foods it is advisable to begin the diet with an addition of a small amount of carbohydrate, 15 to 20 grammes. The reason for this is that certain patients develop quite rapidly a definite acidosis when suddenly deprived of all carbohydrate. A slice of bread, three by four inches, and one-half inch thick, will approximate 10 grammes of starch. Twenty grammes of starch a day, two slices of bread, is adequate protection from serious acidosis. A positive Gerhardt's test may be ignored when the ammonia nitrogen is but 1 or 1.5 grammes per day. On this diet many diabetics cease to excrete glucose within ten days. After the urine has been kept free of

¹ Part of bread allowance may be taken at breakfast.

² The remainder of the day's allowance of bread should be used at this meal.

Obstetrical palsy without dislocation, in most cases, will be associated early with limitation of abduction and external rotation which will gradually disappear, the rapidity depending upon the force applied in stretching the contracted capsule and other soft tissues. The palsy will also gradually disappear but will continue for some time after the motion is complete. If an existing subluxation is reduced immediately after birth, complete recovery will probably follow in the same way. If reduced later, complete recovery will be prevented according to the degree of permanent change in the bones and other tissues from the continuance of the subluxation. The condition which develops is very similar to that associated with an old unreduced dislocation of the shoulder in an adult, the lack of growth being due chiefly to the interference with function during the growing period.

The chief responsibility in these cases, according to my view, will fall upon the physician in attendance at birth. The failure to recognize the frequent occurrence of these subluxations is due to their peculiar obscurity, but when once suspected they can be detected by careful examination. The recognition of the absence of the humeral head or tuberosities immediately in front of the acromion and of the presence of an abnormal prominence behind the acromion, is sufficient for diagnosis. The association of anterior dislocation of the head of the radius, abnormal prominence of the radial head, limitation of movement in the elbow, as found among my cases, indicate that the elbow is also subject to injury at birth. Injuries of the skeleton of the upper extremity, associated with obstetrical palsy, offer a fruitful field for further study. I fully agree with Lange when he says that "the day for the let alone treatment of obstetrical palsy has passed by."

In conclusion I wish to express my indebtedness to Professor G. G. Davis for his encouragement shown in the transferring to me of three cases with posterior subluxation from his service in the University Hospital, and to Dr. J. W. McConnell for his interest and assistance, as a neurologist, in my cases and in other phases of the work.

When the urine becomes free of sugar it is wise to delay at least five days before permitting an increase in the starch ingest. The increase must be made sooner or later if it is possible to do so without inducing a return of glucosuria. In order to facilitate this gradual building up of a diet the unit table is employed. The starch content is expressed in units, instead of grammes, as patients grasp this more quickly; ten grammes of starch is one unit. The values are approximate only. Table II supplements Table I; as all foods in the latter may be used *ad libitum*.

TABLE II.

The food in this list to be taken only in the amounts ordered.

Soups:

Bean	average portion equals one unit.
Clam chowder	average portion equals one unit.
Cream of corn	average portion equals one unit.
Pea purée	average portion equals one unit.
Potato	average portion equals one unit.
Tomato	average portion equals one unit.

Vegetables:

Beans, baked,	2 tablespoonfuls.....	equal	2 units.
Beans, butter,	2 tablespoonfuls.....	equal	1 unit.
Beans, lima,	2 tablespoonfuls.....	equal	2 units.
Beans, kidney,	2 tablespoonfuls.....	equal	2 units.
Beets,	2 tablespoonfuls.....	equal	1 unit.
Corn, green,	1 ear	equals	2 units.
Onions,	2 onions.....	equal	1 unit.
Corn, canned,	2 tablespoonfuls.....	equal	2 units.
Green peas,	2 tablespoonfuls.....	equal	1 unit.
Potato, baked,	1 medium sized.....	equals	3 units.
Potato, boiled,	1 medium sized.....	equals	3 units.
Potato, mashed,	2 tablespoonfuls.....	equal	2 units.

Fruit:

Apple,	1 medium sized.....	equals	2 units.
Blackberries,	2 tablespoonfuls.....	equal	1 unit.
Currants,	3 tablespoonfuls.....	equal	1 unit.
Huckleberries,	2 tablespoonfuls.....	equal	1 unit.
Orange,	1 medium sized.....	equals	2 units.
Peach,	1 medium sized.....	equals	1 unit.
Pear,	1 medium sized.....	equals	2 units.
Plum,	2 medium sized.....	equal	1 unit.
Raspberries,	3 tablespoonfuls.....	equal	1 unit.
Strawberries,	4 tablespoonfuls.....	equal	1 unit.

in weight. The pains have disappeared and constipation has been much improved. He usually has two or three liquid movements a day, sometimes finding it necessary to use a mild laxative. He considers himself relieved of most of his old symptoms.

THE RELATION OF POSTERIOR SUBLUXATION OF THE SHOULDER-JOINT TO OBSTETRICAL PALSY OF UPPER EXTREMITY.

DR. T. TURNER THOMAS read a paper with the above title for which see the February issue of the ANNALS OF SURGERY.

DR. ASTLEY P. C. ASHURST said that he had recently seen at the Episcopal Hospital a child of two years or thereabouts, who had been injured in birth; there was complete flaccid palsy of the upper extremity, and *complete loss of sensation* in the limb, and this had persisted unchanged since birth. This child will chew its own fingers, frequently injuring them in this way, and sometimes burning or scalding them.

Again he had recently operated, at the Episcopal Hospital, on a boy of twelve years who presented partial flaccid paralysis of the upper extremity due to injury at birth, the shoulder-joint was almost flail-like, and if his arm happened to get into the position of extension (behind the patient's body), the head of the humerus became subluxated anteriorly, caused him pain, and he had to pull this arm forward with the other hand. There was also persisting paresis of the muscles supplied by the radial nerve. There was no posterior subluxation of the head of the humerus.

Another case was that of a baby with typical "obstetrical palsy" of the arm sent from Dr. Harte's service in the Orthopædic Hospital to the nervous department for examination. Dr. Boyer found reactions of degeneration present, but on account of the extreme youth of the patient it was not possible to determine very accurately which muscles were at fault.

Last winter he saw, at the Episcopal Hospital, two brothers (one about twelve years old, the other about seven years) who had been similarly injured in birth. In both patients there was distinct posterior subluxation of the shoulder, and the head of the humerus could be felt back of the acromion. Typical paralysis was present, but great improvement had occurred since birth.

Last winter he saw at the Orthopædic Hospital a baby only a few weeks old, who had been injured in birth, by attempted but

Returning to the epigastric region the pyloric extremity of the stomach and adjacent duodenum was found attached to the gall-bladder and liver by abundant adhesions. Portions of these were developed into distinct bands which held up the duodenum. All these were broken up by blunt dissection. The gall-bladder when exposed was not much altered, nothing in its condition calling for intervention. Exploration of the jejunum did not develop any angulation or constriction. All the parts were replaced in as normal a condition as possible and the wound closed.

The patient made an uncomplicated recovery. The immediate relief from the constipation and pain from which he had been suffering was very marked. At the time of making the present report, ten months after the operation, the improvement has continued and the relief experienced has been such as to justify the operation made.

Analysis of this case suggests four individual factors as existing, namely, membranous pericolitis, chronic appendicitis, ileac kink, and duodenal ulcer with consequent gastroduodenohepatic adhesions. The primary condition was due to the pericolic formation, and according to the observations of Flint and Eastman may be accepted as having been embryonic in origin. The later conditions were secondary, infective in character, and creating a succession of lesions which reacted upon each other to produce the progressive pain and discomfort.

CASE XVI.—Lower half of ascending colon and the cæcum constricted by membranous expansion which binds them to the lateral parietes; appendix buried beneath the membrane and chronically inflamed (Hospital No 413)

Woman aged forty-six. A fragile, neurotic woman who applied for relief primarily of symptoms produced by uterine myomata. She also complained of occasional discomfort referred to the right iliac region, accompanied by the formation there at times of a gaseous bunch. Abdominal palpation revealed in addition to the presence of a moderate myoma of the uterus deep tenderness over the appendix and over the gall-bladder. The abdomen was opened by a median incision extending from the umbilicus to the pubis. The cæcum and the ascending colon presented in a state of gaseous dilatation, their walls were congested. A broad, well-marked membranous adhesion constricted the lower half of the ascending colon and the cæcum, binding the intestine

CASES OF OBSTETRICAL PALSY WITH POSTERIOR SUBLUXATION OF THE SHOULDER-JOINT.

CASE I —Reported in ANNALS OF SURGERY, January, 1911

CASE II —Girl, ten years of age, referred by Dr A G Tinney Has been reared by grandparents and nothing is known of the birth except that the right arm has been palsied since It is very little shorter than the left, but is much atrophied, held in marked internal rotation, and can be rotated externally only to a slight degree Can carry the limb at the side of the body, but when unconscious of being observed, as at play, the forearm is flexed in front of the body, the arm is held in slight abduction and the shoulder is depressed, which position attracts attention to the crippled condition Cannot flex elbow to a right angle, can abduct arm at shoulder to about a right angle but passive abduction cannot be carried much further Seems to have some power in all the muscles of the limb, but all are weak, some weaker than others, dorsal flexion of the wrist being particularly weak She generally uses her left hand because of the difficulty in using the right For instance, she cannot raise her hand high enough to write on the black-board at school, except with much straining, and when she does the whole limb trembles and her writing becomes illegible The anterior and outer portion of the acromion is bent downward and seems to be almost directly in contact with the humerus, but this was not observed until after the operation

Operation (August 8, 1911) —At University Hospital, in service of Professor Edward Martin With arm in abduction, capsule exposed by axillary incision between coracobrachialis muscle and large vessels and nerves, and subscapularis muscle divided Capsule opened anteriorly from upper to lower part of joint Finger in joint felt nothing abnormal except poorly developed and irregular head Anterior and upper portion of glenoid margin removed with gouge and scalpel, to permit the head to be pushed upward and forward to its normal place, but this met with only partial success Almost full external rotation was obtained Patient then turned over and posterior portion of capsule exposed by incision along posterior margin of deltoid and division of tendons of infraspinatus and teres minor Capsule divided, head pushed upward and forward, and an effort made

Obstetrical palsy without dislocation, in most cases, will be associated early with limitation of abduction and external rotation which will gradually disappear, the rapidity depending upon the force applied in stretching the contracted capsule and other soft tissues. The palsy will also gradually disappear but will continue for some time after the motion is complete. If an existing subluxation is reduced immediately after birth, complete recovery will probably follow in the same way. If reduced later, complete recovery will be prevented according to the degree of permanent change in the bones and other tissues from the continuance of the subluxation. The condition which develops is very similar to that associated with an old unreduced dislocation of the shoulder in an adult, the lack of growth being due chiefly to the interference with function during the growing period.

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would be necessary to have the possibility of the subluxation in mind and to examine carefully for it in order to find it.

The patient was etherized at the University Hospital, in the service of Professor Edward Martin, August 7, 1913. The subluxation was now more obvious and the bent-down condition of the acromion readily felt. By manipulating the lower end of the humerus outward in abduction and backward with the right hand, and using the thumb of the left hand as a fulcrum behind the humeral head, the latter was forced almost if not to its normal position where it could be felt in front of the acromion. It was evidently covered in great part by the abnormal portion of the acromion, which obscured it. When the pressure was removed, the subluxation quickly recurred. An incision was made about an inch and a half long, along the anterior portion of the acromion. This exposed a triangular projection of the acromion downward for about three-quarters of an inch, which was cartilaginous. The deltoid was detached from its margins, when it was easily pushed upward by the handle of the knife. The humeral head was then rather easily pushed forward and upward to its normal position, when there was a considerable gap between the cut margin of the deltoid and that of the abnormal portion of the acromion from which it was detached. As this was easily bent upward it was not removed except for about a half inch of its tip, and no attempt was made to close the gap between it and the detached deltoid. The skin wound was closed by catgut sutures, a dressing applied, and the limb fixed by a plaster case, with the arm at the side, the elbow in right angle flexion and a little posterior, and the humeral head pushed upward and forward to its normal position. The case was removed August 28, and the arm allowed to hang at the side. The humeral head was in good position. Six days later, the arm hung in the internal rotation position and the head was in the subluxated position, although by external rotation it easily took the normal position. It seems obvious that the posterior portion of the capsule must be shortened before the humeral head will be prevented from slipping back into subluxated position. I had hoped that this shortening would have resulted from the traumatic inflammation following the efforts at reduction and the rest in the fixed position. The change in the bones from the long continued pressure in the abnormal position probably had something to do with the tendency to recurrence of the

whole limb forward about 30 degrees. There was a well-marked wrist drop, but it was not noted at this time that there was any fixation of the wrist in flexion. There were no movements in the fingers except very slight when the palm was tickled. There was marked limitation of passive abduction and external rotation at the shoulder-joint. These notes were taken October 25, 1911, the first time I saw the child, but the parents did not return with it, and I did not see it again until August 18, 1913, when I looked it up to learn what its condition was. There had been a considerable improvement in power in the whole limb, although it was still a much crippled limb. Voluntary abduction at the shoulder to about a right angle, and passive to about 160 degrees. According to my recollection and the statements of the parents, this was a considerable improvement. The whole limb was still held in marked internal rotation and passive external rotation was very much limited. There is an abnormal prominence of the head of the radius and the forearm is turned inward in the cubitus varus position. There is some limitation of extension at the elbow. The hand occupies the wrist drop position and cannot be extended passively to the straight position, although there is considerable gripping power in the hand. The parents are not yet disposed to permit anything to be done to the limb.

CASE V—Boy, ten months old, referred from orthopædic department to nervous dispensary of University Hospital, to be examined by Dr McConnell, and then to me. Weight at birth said to be 13 pounds. Mother small, weight 108 pounds. Birth difficult. Head presentation. Instruments used. Right arm completely helpless immediately after birth. Now has characteristic internal rotation of whole limb, and passive abduction is much limited. Can hold light objects in hand. Has a little power in wrist and elbow, and raises limb at shoulder almost to horizontal. Atrophy of whole limb, but not extreme, and limb slightly shorter than its fellow, which seems to show slight compensatory hypertrophy. Normal angle on outer side at elbow is lost. Dr McConnell observed a mild grade of posterior subluxation at the shoulder, which is evident only on careful examination. He also thought he detected a turning downward of the anterior and outer portion of the acromion, which I was satisfied I could feel, but the mild grade of dislocation and the amount of fat made the shoulder so nearly normal in conformation that it

one A dressing and a plaster case holding the arm in abduction to a right angle and external rotation, were applied Case opened posteriorly and small drain removed on sixth day. No infection and dressings not removed since ¹⁰

CASE IX —Girl, nearly five years of age Very difficult labor Instruments used Shoulders very broad After delivery of face, the severe cyanosis caused the physician to hurry the rest of the delivery by hooking his finger under the right axilla and pulling, when he felt and heard a "crack." Examination afterward excluded a fracture of the humerus which was suspected, but there was a complete paralysis of the whole limb Dr J W McConnell saw the patient at this time and has followed its course since. He diagnosed an injury of the brachial plexus, but asked me to see the case about two years ago The power and movement had improved considerably by this time, but the whole limb was still very weak and there was considerable limitation of abduction and external rotation at the shoulder Not finding a dislocation of the shoulder, I concluded that suitable exercises would restore normal motion and that this would be followed by normal power of the limb These exercises have been kept up since. I had the second opportunity of examining this child very recently. I expected to find that normal motion had returned, but there was still slight restriction of abduction and external rotation, and this led me to examine the shoulder for an overlooked subluxation which I found together with a bending downward of the anterior portion of the acromion It was of mild degree but distinct, notwithstanding which the persistent exercises had produced nearly normal motion at the shoulder and power of the whole limb This case is a striking evidence of the influence of motion on the palsy In size, shape and nutrition there is no discernible difference between the two limbs It shows only in the mild restriction in the

¹⁰ The case was removed after six weeks and exercises began to restore motion Whereas before operation the arm was so weak that the hand could not be brought to the mouth at meals, except by resting the forearm on the table and moving the head toward the hand, twelve days after removal of the case he wrote, "the stiffness is out of the arm so (far that) I can lift it halfway over my head without the assistance of the other I can take off my hat, blacken my shoes and turn on the electric lights." I believe that this early improvement means, merely, that from the better joint conditions he can make more use of the power he had before operation

and much atrophied, those of the shoulder and arm most, of the forearm less and of the hand least (see Fig 15) Can raise the whole arm forward almost to a right angle Flexion at the elbow is very weak, of extension much stronger but still much below normal Rotation of forearm very weak Movements of wrist and hand fairly strong but much weaker than of left side The posterior subluxation is marked The acromion has not the normal inclination from the anterior margin downward and backward but is more horizontal from before backward, indicating that it had sustained pressure from above downward, especially at its anterior portion which is normally the higher and would first receive the pressure from some object above it At operation, the coracoid process showed distinct evidence of having been bent backward at birth, which may have protected the acromion from the marked bending downward seen in the other cases

Operation (September 22, 1913) —At the University Hospital, in the service of Professor Edward Martin Incision along anterior and outer margin of acromion, through the deltoid and exposing the upper end of the humerus The sharp bending downward of the anterior portion of the acromion discovered in the two preceding operations, was not found, but the more horizontal position was evident It seemed to be bent downward slightly as a whole External rotation was stubbornly resisted until the subscapularis tendon and the underlying capsule were divided, when there was a considerable gap between the divided margins With the arm in external rotation, the humeral head could be pushed forward so far that there was no prominence behind the acromion, but it could not be pushed forward and upward far enough to make a prominence in front of the acromion It could be seen that this was prevented by the contact of the head against the coracoid process, which seemed to have bent backward considerably at birth The patient was then turned over and an incision made through the posterior fibres of the deltoid, exposing the tendons of the infraspinatus and teres minor, which were divided near the greater tuberosity with the underlying capsule The finger in the joint found the glenoid cavity flat from side to side but concave from above downward With the head pushed as far forward as possible, the margins of the tendons and capsule were overlapped by catgut sutures about $1\frac{1}{2}$ inches Both wounds closed with a small drain in the posterior

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to the lateral parietal wall. When this was divided and reflected and the ascending colon was drawn medially, the appendix came into view buried by the cæcum and covered by membranous folds. It was in a condition of chronic inflammation. It was removed. Two myomatous masses were then enucleated from the uterus. The raw spaces left after the various procedures were covered in by peritoneum and the abdominal wound closed as usual. Operative recovery uncomplicated.

CASE XVII—*Membrane reflected from cæcum over appendix to peritoneum lining iliac fossa, appendix acutely inflamed, membrane congested* (Hospital No 415)

A woman thirty-three years of age. Admitted with symptoms of acute appendicitis. Inquiry elicited a history that ten years ago she had an attack of acute pain in the right iliac fossa. Repeated attacks since that time. The last attack two years ago. Admitted with typical symptoms of acute inflammation of the appendix. When the abdomen was opened a generally congested cæcum presented, behind which was a mass fixing the cæcum to the iliac fossa, within which the appendix was buried. The appendix was enucleated in a condition of acute congestion. Associated with this congestion of the appendix there was a distinct membranous reflexion passing from the appendix over upon the lower anterior portion of the cæcum. In this ran many turgid venules. This membrane was distinctly organized and plainly differentiated from the inflammatory exudate in which the appendix was embedded. It was necessary to divide and reflect this membranous covering before the appendix could be enucleated. The appendix was removed by the usual method, the raw peritoneal surfaces covered in by suture. Uncomplicated recovery.

CASE XVIII—*Cæcum covered in by pericolic membrane, meso-appendix continued upward on to terminal ileum, and by reason of inflammatory fixation of appendix into right iliac fossa constricting and making tense the ileum (obstructive ileac kink), dilatation of ileum, ulcers of duodenum and of stomach* (Hospital No 431.)

Man sixty-nine years of age, of apparent good general physical condition. For many years, however, he had suffered from gastric symptoms, consisting of spells of pain and burning and indefinite distress in the epigastric region, coming on three or four hours after meals, waking the patient at night. These attacks would be

range of movement in the affected limb The subcutaneous fat is greater than usual for this age, and gives to the affected shoulder almost if not perfectly normal roundness This is the second case in which I overlooked a mild subluxation on my first examination (see Case VII)

It may be argued that the failure to recognize the subluxation in this and Case VII in my first examinations shows secondary development of the subluxation from an injury to the brachial plexus I am satisfied that it merely indicates a lack of familiarity with the condition at the time of my first examinations Both cases were seen only a short time after I saw my first case, in which I recognized the dislocation only after a prolonged examination I thought it of mild grade but, with the exception of Case VIII, it was the most aggravated of all my cases The two that were overlooked are about the mildest I saw Case VII at about 8 months of age, this one (IX) at about three years of age Fairbank says that at the end of two months the paralysis has so largely recovered that electrical examination is usually unnecessary Such a paralysis is hardly likely to develop secondarily a subluxation after 8 months or three years My failure to recognize an existing subluxation in these two cases is easily accounted for by its mild grade, the amount of fat and my inexperience I had not then developed what I regard as the pathognomonic sign, the absence of the normal prominence of the upper end of the humerus immediately in front of the acromion This last case is a striking example of what can be accomplished in birth palsy by restoring motion to the shoulder-joint. Reduction of the subluxation is the great indication because perfect motion can occur only in a perfect joint

definitely to which class the fractures belonged except in those occurring during 1911 and 1912. Of the 40 cases demonstrated by X-ray in 1911 and 1912, 8 were fractures of a considerable portion of the process, 1 was an epiphyseal separation or separation at the epiphyseal line, 25 were sprain fractures, 6 could not be traced.

It is at once evident that fractures including a considerable portion of the process are few compared with the sprain fractures.

It must be apparent also that such fractures present no features as to diagnosis etc., in any way differing from fractures in general. A typical example is shown in Fig. 1.

The separations at the epiphyseal line are, as far as causation and symptomatology go, merely a subdivision of the fractures of the first class (see Fig. 2).

The sprain fractures furnish the most numerous and in many ways the most interesting subdivision. True sprain fractures by tearing due to ligamentous pull, are found in three locations. (1) most often at or above the acromio-clavicular junction; (2) at the insertion of the coraco-acromial ligament; (3) the upper surface of the acromion—usually the location of the smallest of the sprain fractures.

These sprain fractures have been noted in the order of frequency of their occurrence. Some of them are quite easily evident on the X-ray plates; others again are most minute. In several instances in which a sprain fracture was noted the diagnosis according to the X-ray plate seemed to me to be doubtful indeed. But a very minute sprain fracture cannot be demonstrated by X-ray, certainly not when only a few hardly perceptible fragments of the bone are pulled loose. It is beyond question that in the majority of instances the diagnosis was based upon substantial grounds.

The fourth variety of sprain fracture or at least fracture of a very small portion of the acromial tip are due very evidently to a force exerted directly either (a) by the pressure of the humerus from below, or (b) by direct violence to the acromion process.

THE FREQUENCY AND SIGNIFICANCE OF INJURIES TO THE ACROMION PROCESS.¹

BY J. BERNHARD MENCKE, M.D.,

OF PHILADELPHIA,

Assistant Surgeon to the Out-Patient Department of the German Hospital, Assistant Surgeon to the Stetson Hospital

RECENT studies of the etiology and pathological anatomy of certain injuries to the shoulder-joint have done much to make clear the causes of severe symptoms often found when gross lesions of the tissues are not demonstrable by examination. Such facts, however important, should not make us lose sight of that great class of cases in which some lesion to the bony structures of and about the joint may be shown, by X-ray if in no other manner.

The work of Ross and Stewart has called attention to the importance of sprain fractures in the causation of severe symptoms and has made it plain that the extent of a bony lesion by no means determines its immediate symptoms or sequelæ.

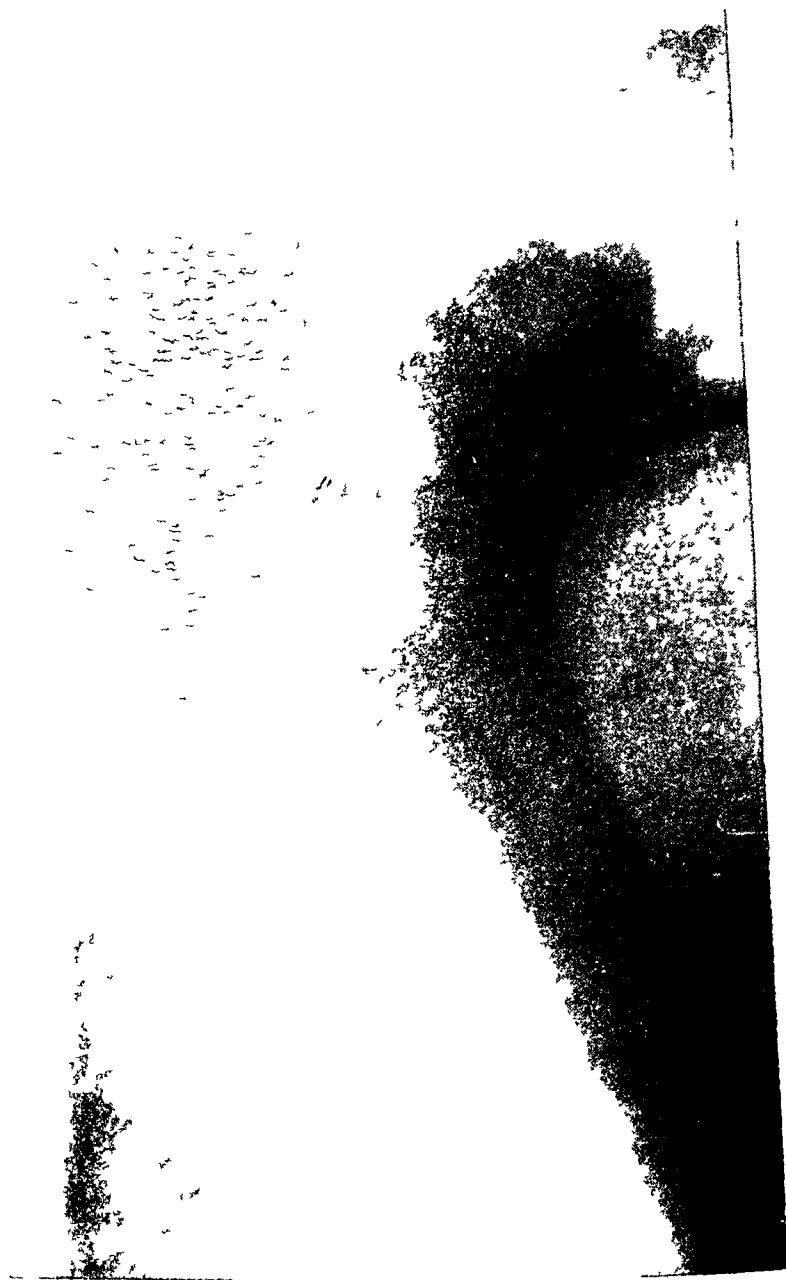
In acromial injuries we find a group of conditions often apparently trifling which, nevertheless, are of importance both as to the symptomatology of the lesion itself and because of the significance which a lesion may have in indicating the occurrence of other injuries.

Fracture of the acromion is a very common injury. An examination of the records of the German Hospital for eight years, from 1905 to 1912 inclusive, resulted in finding 89 cases of acromial fracture.

When there is a fracture of the acromion it is one of three classes: (1) A well-marked fracture of a considerable portion of the process, (2) a separation at the epiphyseal line, (3) a sprain fracture.

Of the cases mentioned it was impossible to determine

* Read by invitation before the Philadelphia Academy of Surgery, November 3, 1913.



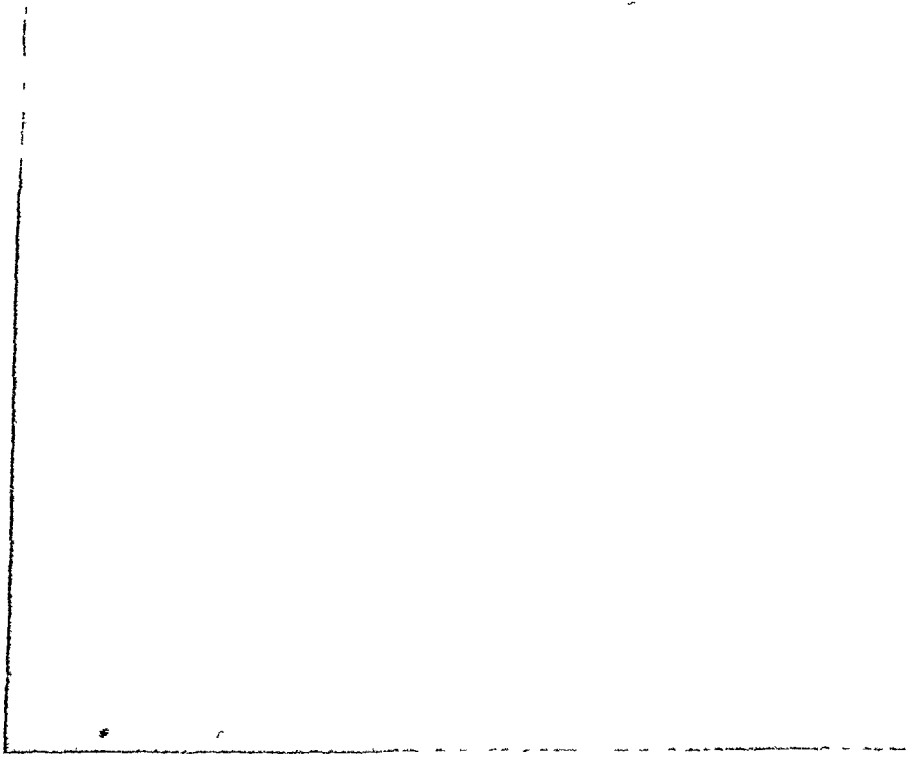
^ to epiphyseal line of acromion with sprain fracture of upper surface of acromion

FIG 1



Fracture involving acromion process

FIG 3



' Chipping " of outer and lower portion of acromion process by force exerted through the humerus

erted upon the upper extremity of the humerus are of great interest because they furnish us probably with an explanation of the severe symptoms often accompanying what seem to be very insignificant acromial injuries

Before considering these conditions we must take into account the method of causation of acromial injuries

In all but a few instances in which there is some history of the injury, to be correct, in 8 of the total number of 89, a fall is given as the cause of the acromial lesion. In a considerable proportion of the cases the history stated that a "fall on the shoulder" took place. I believe that these histories are generally incorrect. Codman, who is in this supported by Thomas, has drawn attention to the unreliability of such statements as to shoulder injuries. It is no easy matter to fall in such a way that the first impact is upon the tip of the shoulder.

The only other explanation possible is that, where the acromial injury is not a direct one, it is caused by a force transmitted or applied by the humerus. The possibility of this I have seen mentioned by Dr G G Davis. It is the frequency of this sequence of events that I wish to emphasize. Now since in a fall the arm is practically always thrown away from the body—abducted—we find that the force is applied to the acromion by the greater tuberosity of the humerus, the shaft of the humerus acting as the long end of the lever. It may be possible for a direct upward push on the humerus to do the same thing, the scapula being fixed. One of the series of cases I studied sustained the acromial injury while cranking an automobile and this may be such a case.

The force applied to the acromion may then (a) clip its outer end (as Fig 3), (b) "spring" the acromio-clavicular junction, or (c) put too much strain upon the coraco-acromial ligament.

In any of these conditions, the acromial fracture or sprain fracture results.

It is evident, therefore, that a minor degree of acromial injury may be the net result in damage to the bony structure of considerable violence.

Some of them in extent and appearance are such that I find them in my records noted as "bruises of the tip of the acromion"

Of the total of 89 cases of fracture of the acromion, 18 were found with other lesions also demonstrable by X-ray. These were 3 instances of associated injury to the clavicle at its acromial end, 3 instances of fracture of the acromion with luxation of the acromial end of the clavicle, 3 instances of old luxation of the humerus, 2 instances of subluxation of the humerus, 1 instance of fracture of the greater tuberosity of the humerus, 1 instance of luxation of the head of the humerus and of the clavicle, 1 instance of luxation of the humerus with fracture of the clavicle, 1 instance of fracture of the head of the humerus with luxation of the clavicle, 1 instance of fracture of the "upper end" of the humerus, 1 instance of comminuted fracture of the surgical neck of the humerus, 1 instance of fracture of the coracoid process and of the head of the radius

It will be seen at once that these injuries associated with acromial fractures, sprain fractures or otherwise, group themselves into two great classes

- 1 Conditions affecting the acromio-clavicular junction.
- 2 Associated injuries indicating a violent trauma involving the upper end of the humerus and producing either a luxation of the humerus or a fracture

Since sprain fractures of the acromion are by far more common than any other form of fracture of this part, and since most of the sprain fractures involve the acromion at the acromio-clavicular junction, it is not surprising that at times there should be a similar lesion of the acromial end of the clavicle. And, luxation so-called of the acromio-clavicular articulation, as shown by the X-ray, is but one step further in an acromio-clavicular disjunction. I have never seen such an occurrence in which this separation, accompanying merely a sprain fracture of the acromion, was clinically demonstrable

Those cases of injury to the acromion in which we have, as in the old or unreduced luxations of the head of the humerus or the fractures of the humerus, evidence of great force ex-

I was not able to examine, an apparently permanent disability of the shoulder resulted

It must be evident that while a fracture or sprain fracture of the acromion should and does cause localized tenderness and pain, and pain upon abduction, these symptoms should cease with proper treatment, at a time when bony or fibrous union has taken place. The persistence of symptoms points to the existence of a concomitant shoulder condition. There has been much said concerning subacromial bursitis as causing stiff and painful shoulders. I have never seen any case in which I could make this diagnosis.

We must then consider the accompanying lesion as being, as has before been stated, a luxation of the head of the humerus, spontaneously reduced, or an injury just short of producing luxation but with similar injury to the joint capsule.

In the clinic at the German Hospital we have been fortunate in avoiding bad end results in cases showing fracture of the acromion, because we treat every case, however slight, of injury to the acromion by rest for three weeks, with early massage and later, if necessary, by vigorous active and passive motion.

In conclusion, then, I believe we may safely state

- 1 That injuries to the acromion process are not infrequent
- 2 That they are important not only because the injuries themselves cause more or less pain and discomfort, but especially because practically all acromial injuries are caused by indirect force applied by the humerus acting as a lever and therefore an injury of this kind to the acromion is evidence that there has been either luxation spontaneously reduced or, as is more often the case, a lesion nearly approaching luxation with a corresponding injury to the joint structures.

I am indebted to Drs G G Ross and A D Whiting, my chiefs in the German Hospital Out-Patient Department, for permission to report these cases and to Dr A G Miller, the radiographer of that institution, for his kindness in furnishing the plates I have brought and his many demonstrations on this subject to me, and to the Fellows of the Academy for the opportunity to present this paper.

The association of acromial fracture with luxation of the head of the humerus gives rise to several questions of importance. I was very much interested in Dr. Thomas' explanation and demonstration of acromial injuries associated with the birth palsies of children, which he has found to be the result not of nerve lesions but of injury to the bony and ligamentous structures of the shoulder.

The fact that we occasionally find injuries to the acromion with luxations at the shoulder leads us to consider two possibilities: (1) That many cases of acromial injury are associated with luxations of the shoulder which become spontaneously reduced, (2) that the giving way of the acromion or of the structures attached to it accompanies trauma not quite sufficient to cause complete luxation, yet sufficient to injure the capsule of the joint and thus produce subsequent symptoms.

The spontaneous reduction of a shoulder luxation is beyond a doubt possible but in the majority of instances of acromial injury the examination fails to reveal evidences that actual luxation has occurred. We are thus thrown back upon the second possibility. It seems to me most likely that the application of a force in abducting the shoulder sufficient to produce a fracture of the acromion must be such as to produce an accompanying injury to the contiguous soft parts.

The symptomatology of acromial injuries, even of the sprain fractures apparently most insignificant, bears us out in this view.

A certain proportion of these cases show immediately after injury only the two symptoms referable directly to the acromial condition, *i e*, localized tenderness over the acromion at the seat of injury and pain on abduction. After the lapse of three or four weeks these cases recover, occasionally, however, requiring active massage and passive motion for an equal length of time before recovering full function. Most cases of such injury, however, run a more severe and protracted course. Tenderness over the acromion is persistent and pain here and throughout the shoulder is complained of. Abduction is limited and in at least two cases that have come to my notice but which

STENOSIS OF THE PYLORUS IN INFANCY.

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THE subject of this paper will be considered in four divisions. First, a systematic statement of the facts of the disease, second, reasons why the treatment should be surgical, third, a consideration of two problems which have arisen in connection with the study of these cases; and fourth, a report of my own experience with this disease

I A SYSTEMATIC STATEMENT OF THE FACTS OF THE DISEASE.

The Pathology.—A pyloric tumor is always present. It is about the size of the terminal phalanx of a finger or thumb, oval in shape, smooth of surface, firm or hard, like cartilage. There are never adhesions about it. The lumen of the pylorus is narrowed. The longitudinal folds of mucous membrane are enormously hypertrophied, adding to the narrowness of the lumen. This tumor is caused by an overgrowth and an hypertrophy of the circular muscle fibres of the pylorus. The tumor is a muscle tumor, it represents an overgrowth of muscle tissue.

The tumor is as evident at autopsy as upon the living. It exists in the living, whether gastric peristalsis is present or not. It is no more evident to direct touch when gastric peristalsis is present than when there is no gastric peristalsis. It is a passive tumor. Muscle contraction is not necessary to its existence.

That the pyloric tumor encroaches upon the lumen of the pyloric canal is proven not only by the clinical signs in these cases but by direct examination of the stomach at autopsy and at the operating table. The tumor itself is sufficient cause for the obstruction to the pyloric canal. The obstruction is an an-

relieved completely and immediately upon the ingestion of food and alkalies. After such attacks, varying from a few days to several weeks, there would be intervals of complete freedom from discomfort. During more recent years he has complained of fullness and aching in the region of the cæcum. During the two weeks immediately previous to admission he had passed several tarry stools. He was then seized with an acute prostrating pain referred to the epigastrium, with vomiting of large quantities of coffee-ground material. When admitted he was in a condition of shock, with weak pulse, 140, dyspnoea, distended and rigid abdomen, a tympanitic resonance in the hypogastric region, and with marked rigidity and tenderness in the right upper quadrant of the epigastrium. The abdomen was opened through the right upper rectus muscle. Several quarts of grumous material mixed with food were found in the peritoneal cavity. The pyloric end of the stomach was covered over by dense adhesions which fastened it to the posterior wall of the abdomen so densely that no liberation under the circumstances was possible. Just proximal to the pyloric vein on the lesser curvature was a patent ulcer the size of a ten cent piece, from which poured great quantities of grumous material. The ulcer opening was closed in by a row of Lembert sutures, over which was tacked the omentum. The peritoneal cavity was wiped out as well as possible. Counter incision was made on the right flank and one below the umbilicus for drainage. A drain was also left in the epigastric wound. The patient did not rally and died five hours after operation.

Upon postmortem there was found an old very definite pericolic membrane covering in the cæcum. The appendix, partially obliterated, was bound down to the right iliac wall by dense adhesions. Continuous with the meso-appendix was a proliferative fat laden mass of tissue which continued up over the ileocæcal junction and on to the ileum. This by reason of the fixation of the appendix to the right wall of the iliac fossa markedly constricted the lumen of the ileum. The ileum proximal to this constriction was markedly dilated. The wall of the gall-bladder, thickened, was covered by old inflammatory bands, its mucosa in a condition of chronic inflammation. The gall-bladder had been drawn down and become adherent to the upper surface of the duodenum and was involved in an old scar process which joined them to the head of the pancreas behind. The head of the pancreas

which is said to occur in certain of these cases. If it is likely that a congenital overgrowth of muscle is the cause of the tumor, then spasm, which has never yet been known to have caused a hyperplasia, is removed still further from the field of symptomatology in these cases. I think it will appear as the facts concerning this disease are unfolded that spasm has but little to do with these cases of tumor obstruction.

The Symptoms—The symptoms are those of obstruction. The patient is usually a healthy appearing breast fed boy. There is at first, often overlooked, loss of appetite. The baby does not care to nurse. Vomiting appears soon after birth or within the first two or three weeks. This vomiting is characterized by its persistence and its projectile character. It is the vomiting of obstruction. The quality of the food seems to make no difference with the vomiting, the vomiting depending rather upon the quantity taken. The amount of the vomitus depends largely upon the amount of the feeding. The material vomited is the food taken. The vomitus never contains bile, an excess of HCl, blood, mucus, or lactic acid. Because of the little material passing through the pylorus into the duodenum the baby is constipated. The dejections are consequently small in amount; there being very little milk residue the stool, consisting almost entirely of bile, pancreatic juice, and cast-off epithelium, is meconium-like.

There is a progressive loss of weight. The child has not been receiving sufficient nourishment to keep the weight up to the normal gain. Instead of the normal gain there is an actual loss. There may be erratic gains in weight which subsequently are lost. If the baby's abdomen is uncovered while the baby is feeding, or while the baby is taking water from the bottle, there will be noticed rather vigorous peristaltic waves passing across the upper half of the abdomen from left to right. This visible peristalsis is very marked in many cases. The stomach is contracting violently in the attempt to overcome the obstruction. If the abdomen is palpated from the side and from before backward, in about from 60 to 80 per cent. of the cases it will be possible to feel the tumor between the thumb and

atomic one, and is not necessarily dependent upon physiologic causes. The significance of this fact will appear later.

All other pathologic changes are secondary to the obstruction caused by the tumor, viz, the thickened or stretched gastric wall, the dilated œsophagus, the empty intestine, the emaciated and wizened body of the baby.

The Etiology—What is the cause of this tumor found at the pylorus in these new-born babies? This has been the subject of much speculation. The most likely hypothesis is, I think, the one that considers it a congenital anomaly. The tumor represents a congenital overgrowth of muscle tissue. In support of this view are the following considerations:

- 1 The earliest indications of the presence of a pylorus is in the third month of fetal life. There is, therefore, ample time for the growth of muscle tissue to take place.

- 2 There is one case recorded in literature by Dent of a pyloric tumor in a seven months old foetus. The tumor shows the same structure that is found in the stenosis cases examined after birth.

- 3 The symptoms in these cases appear so near to birth that it is impossible to conceive of the overgrowth of muscle as having taken place between birth and the onset of symptoms. My youngest case was only 14 days old.¹ The tumor in this case was fully developed and as definite as those seen in cases 3 months old.

- 4 The tumor is associated occasionally with other congenital defects, such as imperforate anus and club foot.

- 5 Aberrant Brunner's glands that normally belong only in the duodenum have been found in the tumor at the pylorus. It seems to me therefore that the evidence at hand favors a prenatal or congenital overgrowth of muscle tissue as the best explanation for the tumor present in these cases of infantile pyloric stenosis.

Why talk of or consider the etiology? Because it is important to determine the significance of spasm of the pylorus.

¹ Boston Med and Surg Jour, December 14, 1905

The serious and desperate cases are the ones that may become confused with the true tumor cases. These desperate spasm cases may occasionally but very rarely require surgical treatment.

The employment of the X-ray for diagnosis in these doubtful cases is likely to prove of a good deal of assistance. The behavior of the stomach in a normal baby after the milk of bismuth has been introduced into it is definitely known. The behavior of the stomach in a case of pyloric obstruction due to tumor when the milk of bismuth is introduced is likewise known. If bismuth is introduced into the stomach of a baby having a supposed pyloric spasm, the behavior will be often different from the record in either of the other two conditions. This difference may be helpful in the differentiation of these conditions. Every suspicious case of pyloric obstruction in which there is doubt as to whether there is a tumor or not should be X-rayed. The subnitrate of bismuth may be administered by mouth and the stools watched for the appearance of bismuth crystals (Talbot). The appearance of these crystals in the stools will be indicative of something passing through the pylorus. If the stools are infrequent and small in amount, these facts in themselves may be significant.

The Prognosis—The mortality of this disease is high. Most cases of congenital pyloric stenosis die of starvation. The question is how long will it take a small baby to starve to death while the family physician experiments with drugs and foods, which under the conditions are absolutely of no use. It will take about three months, and this is the usual length of life of these small babies. Of course, the degree of obstruction in these cases, as has already been pointed out, varies. A baby with considerable obstruction will live a shorter time than a baby who has less obstruction, other things being equal.

There are cases being reported each year of young adults who have suffered during infancy and childhood from partial pyloric obstruction. Such individuals reaching maturity after years of gastro-intestinal invalidism, poorly nourished, and probably under-developed,—such individuals are more fre-

finger This will be noticed more readily just after the peristaltic wave passes the pyloric portion of the stomach. The tumor may be obscured by an enlarged liver and mistaken for enlarged lymphatic glands, or even for the lower pole of the right kidney The stomach itself will be dilated, particularly if the baby has lived some time after the obstructive symptoms have been present

The obstructive vomiting, the palpable tumor, the visible peristalsis, the meconium-like stool, the epigastric fulness, the continual loss of weight, these are the symptoms of pyloric obstruction in infancy Despite experiments with feeding and the use of drugs of various sorts, the baby gradually wastes away and dies of starvation The baby dies of pyloric obstruction

This is the typical picture of an unrelieved pyloric stenosis in infancy, and it is the usual termination The death certificates in cases of this kind in the past, and also to-day, are often signed by the attending physician, inanition, acute gastritis, infantile atrophy, gastro-intestinal catarrh, marasmus, dyspepsia or pyloric spasm

Diagnosis—The diagnosis in typical cases is comparatively easy However, there are many cases of babies difficult to feed who may be suspected of having a pyloric tumor Pediatricians have employed the term "spasm of the pylorus" in order to explain the obstructive symptoms seen in little babies who suffer from persistent vomiting, and in whom there is no demonstrable tumor This idea of a spasm of the pylorus is a purely hypothetical notion introduced by clinicians to account for symptoms which they are otherwise unable to explain There is little doubt that there is a group of cases difficult to feed which is fairly easily explained by the idea of pyloric spasm without the tumor These supposedly pure spasm cases occur in bottle-fed, excitable, irritable, neurotic babies The onset of symptoms is several weeks after birth The stools contain fecal material A pyloric tumor, if felt, is felt only when the gastric contraction occurs The vomiting lacks the characteristics of the tumor cases Cases of obstruction from pyloric spasm sometimes die from starvation

cases of others who have thought that they have been treating tumor cases with success is to be accounted for upon the basis of mistaken diagnosis, or a temporary and not a permanent cure.

It was about 23 years ago that the pyloric tumor cases were first well described. During all these 23 years the physician has painstakingly striven to treat such cases by medicines and by carefully prescribed feeding. The estimated mortality from an expectant medical treatment is between 80 and 90 per cent (Monier). It is upon this carefully studied medically-treated post-mortem material that much of our present pathologic knowledge of this disease is based. The medical treatment of the tumor cases has signally failed to effect a cure.

What has surgery already accomplished in the care of these cases? Surgery has gradually lowered the mortality in the treatment of these cases. The mortality, once high, very distinctly is decreasing. The first time surgeons attempted to treat this disease was in 1898. From 1898 to 1905 is a period of seven years. During this period gastric surgery was developing. Operative technic was unsettled. The choice of procedure adapted to certain conditions was undetermined. This was an experimental period for gastric surgery in the adult and absolutely a new field in infants. Several different operations were done by many operators for the same condition. The cases operated upon had gone almost the limit of life under medical experimentation. Is it any wonder that the mortality from surgical operation during this period upon such material was very considerable? The mortality for this period was 46.5 per cent. No apology is needed here for this mortality, for more than half the babies entrusted to the surgeon were saved by operation. Even this was a great improvement over the medical mortality.

Consider now the next 7 years, the period from 1905 to 1912. The lowering of the mortality under surgical treatment has been remarkable. I have not yet collected all operated cases during this period. I have three groups, however, which are fairly representative of the period.

quently than formerly being recognized as instances who as babies have had a partial pyloric obstruction and have survived despite the obstruction Hezekiah Beardsley,² in 1788, reported the case of a child who had lived five years with a pyloric tumor, which was determined at the autopsy Habersohn,³ Lebert,⁴ Landerer,⁵ Rudolph Maier,⁶ Dunne,⁷ Tilger,⁸ and Barling,⁹ all have reported cases of this sort.

II TREATMENT

I believe that the treatment of stenosis of the pylorus in infancy should be surgical as soon as the diagnosis is made, and for the following reasons

That the pure pyloric spasm obstruction can be cured by medical treatment in a large proportion of cases is true It is also true, so far as I am able to learn, that there is no case of true tumor which has yet been cured by medical treatment So far as I am able to determine, no so-called medically "cured" case has even been proven to have had the disease, but on the other hand many cases of supposed "cure" have relapsed and have been subsequently treated surgically The tumor has been demonstrated to exist and a cure by surgical means has followed Those who advocate and practise the medical treatment of true tumor cases do so upon the erroneous hypothesis that muscle spasm is the chief cause of the obstruction They lose sight of the fact that it is the tumor that obstructs At best, medical treatment relieves only hypothetical spasm that perhaps accompanies certain tumor cases Medical treatment does not effectively remove the primary cause of the obstruction

The improvement in Heubner's series of cases and in the

² Beardsley Hezekiah Trans New Haven Co Med Soc, 1788

³ Habersohn Diseases of the Abdomen, 1862

⁴ Lebert Diss, Tübingen, 1878

⁵ Landerer Diss, Tübingen, 1879

⁶ Maier, Rudolph Virchow's Arch, Bd cii, s 413, 1885

⁷ Dunne Jahresbericht d Jenner'schen Kinder-Hospitals, Bd xix, 1881

⁸ Virchow's Arch, Bd cxxxii, s 290, 1893

⁹ Barling The London Lancet, January 29, 1913, 1913

has no deleterious effect upon the metabolism as measured by the digestion of fat, protein and starch and the normal development.

These experiments serve to confirm the work of Cameron and Paterson and make it absolutely conclusive that in the otherwise normal individual a posterior gastro-enterostomy has no harmful effect upon digestion, so that the opposition to this operation cannot be based upon any such conception as stated above

(b) The second question that arises in connection with these cases is what becomes of the muscle tumor at the pylorus; does it disappear as the child grows older? I think from the evidence at hand that it probably persists and does not disappear, and for the following reasons.

(1) Through the assistance of Dr W J Dodd, of Boston, skiagrapher at the Massachusetts General Hospital, and instructor in Roentgenology in the Harvard Medical School, I have been able to obtain further X-rays upon this series of stenosis of the pylorus cases operated upon by me, and these X-rays show uniform findings. In every case, no matter how many years following operation, the bismuth meal is seen to pass through the stoma, and in only a very few is it seen to pass in slight amount through the pylorus. In other words, the obstruction at the pylorus, which has been proved in each of these cases to have existed, is demonstrated by the X-ray to still exist. The tumor is still present and still obstructs.

(2) It has been demonstrated by certain physiologists that if the pylorus remains open and is unobstructed the stomach contents will be forced through the pylorus even though an artificial stoma be present. On the other hand, it has been demonstrated that if the pylorus has been closed by some form of obstruction either partially or completely, the food will be forced through the artificial stoma in whole or in part. In these cases the food is seen to be going through the stoma and it is reasonable to suppose, therefore, that the obstruction still persists. In other words, the physiological evidence confirms the evidence from the X-ray.

1 The group of ten operated cases from the Pacific Coast, collected by Stillman In this group six different surgeons operated A posterior gastro-enterostomy was done in each case Of the ten cases only one died

2 The group operated upon by Richter, of Chicago There were 9 cases, only one died

3 My own group of 17 cases with 3 deaths, a mortality of 17.6 per cent A total, therefore, of 36 cases with 5 deaths, or a mortality of 13.8 per cent

The mortality of posterior gastro-enterostomy in congenital stenosis of the pylorus is low under the above conditions

III CONSIDERATION OF TWO PROBLEMS

There are two important problems which this group of cases helps to solve

(a) What is the effect of gastro-enterostomy upon the metabolism of the body? There are those who think that a gastro-enterostomy impairs digestion The passage of the food through the artificial stoma is looked upon as a real harm to the individual Digestion, they say, cannot proceed in the proper fashion and the individual will suffer because of such impairment of digestion

In order to determine the effect of gastro-enterostomy upon digestion it occurred to me that these babies with congenital stenosis might serve for metabolism investigations The work done by Dr Talbot, of Boston, upon a series of babies who had had a posterior gastro-enterostomy done for a stenosis of the pylorus has demonstrated that in these cases there is no impairment of the digestion of fat, starch and protein The details of these experiments together with the results, I have already reported with Dr Talbot in a former paper¹⁰ If to the chemical evidence thus obtained be added the clinical fact that all these babies, without exception, are apparently thriving and in perfect health, have lived several years following the operation and gained in weight and height, the evidence is overwhelming that in these human babies gastro-enterostomy

¹⁰ Surg, Gynec and Obstet, September, 1910, pp 275-287.

was hard and infiltrated. There were in this region many old cicatrices proximal to the pylorus. It was stenosed to an opening about $\frac{1}{4}$ inch in diameter. On the lesser curvature of the stomach there was a perforation the size of a ten cent piece, which opened freely into the peritoneal cavity. On the posterior inferior wall of the pyloric antrum extending to the pylorus proper was a perfectly healed, punched-out round ulcer. The pyloric sphincter itself had been replaced by scar tissue. On the duodenal side of the pylorus on the posterior wall was a third ulcer, the size of a ten cent piece, with clean edges, which had perforated completely through all the layers of the intestinal wall into the substance of the pancreas which formed its base. The stomach itself was dilated.

The sequence of pathological conditions in this case was evidently first, the pericolic membrane, the chronic appendicitis, the angulation and constriction of the ileum, secondary to which in course of years developed the conditions in the upper abdomen which led to the final catastrophe.

CASE XIX — *Cæcum and appendix fixed in the right iliac fossa by a mass of adhesions of inflammatory origin, distinct from these a membranous layer covering the posterior outer surface of the cæcum and binding down the chronically inflamed appendix, first part of sigmoid flexure adherent to left brim of pelvis, old salpingitis* (Hospital No 438)

Woman, thirty-five years of age. Applied primarily for relief from vesical irritability. Upon examination it was found that she had a patent urachus and that she also suffered from chronic endometritis, chronic salpingitis, and chronic appendicitis. She was the subject of habitual constipation, and suffered from accumulations of gas in the colon. She had been operated upon two years before for hemorrhoids. Cystoscopic examination of the bladder revealed no bladder conditions which accounted for her symptoms. The uterus was curetted. The persistent urachus was exposed by a longitudinal incision, isolated and extirpated. The tubes and ovaries presented evidences of former inflammation which had now degenerated into sclerosis. The head of the cæcum was bound to the right brim of the pelvis by a strong band of adhesions. After these had been divided the posterior outer surface of the cæcum was found covered by a distinct membranous layer, beneath which the appendix was imprisoned. This was

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¹⁰ Surg., Gynec. and Obstet., September, 1910, pp. 275-287.

Mass The operation was done by Dr C L. Scudder A boy baby He was breast fed His weight at birth was $6\frac{3}{4}$ pounds He vomited soon after birth and constantly until the operation on the 24th day The vomiting occurred usually after several feedings and came in spurts Gastric peristalsis was observed after each feeding No tumor was felt The child lost in weight and strength At operation a tumor was seen and palpated at the pylorus The operation was a posterior gastro-enterostomy When he was three years and eight months old his general diet was milk, eggs, broths, never meat excepting chicken occasionally, bread, crackers, potatoes, Ralston food, cereals, peanut butter, butter, celery, turnips, fruit.

Weight, May 24, 1910, $37\frac{1}{4}$ pounds, when three years and eight months old See Figs 3, 4, 5, 6 (1910)

In February, 1913, a bismuth X-ray was taken of the child's stomach and he was apparently perfectly well Bismuth leaves by the stoma He is now eight years old See Fig 7 (1913)

CASE III—Colby¹⁴ Patient of Dr J L Morse, of Boston, and Dr Day, of Newburyport The operation was done by Dr C L Scudder A boy baby He began to vomit when he was 16 days old and the vomiting was constant until the operation on the twenty-second day The material vomited was the milk taken The vomitus contained no bile The baby was breast fed He had lost in weight Gastric peristalsis was observed A pyloric tumor was felt At operation the tumor was seen and palpated at the pylorus The operation was a posterior gastro-enterostomy The child's bowels are never constipated

When he was two years and five months old his diet consisted of milk, soft boiled eggs, steak, lamb, and broths, butter, bread, cereal, potatoes, macaroni, puddings and fruit See Figs 8, 9, 10 (1910)

In February, 1913, a bismuth X-ray was taken of the child's stomach, and he was apparently in perfect health The bismuth leaves the stomach by the stoma He is now seven years old See Fig 11 (1913)

CASE IV—Stevens¹⁵ A patient of Dr Charles Putnam, of Boston The operation was done by Dr C L Scudder A boy baby The child was breast fed and artificially fed He began to vomit when he was 14 days old The material vomited was the milk taken The vomitus contained no bile Gastric peristalsis

¹⁴ Reported in the Boston Med and Surg Jour, August 6, 1908

¹⁵ Reported in the Boston Med and Surg Jour, August 6, 1908

has no deleterious effect upon the metabolism as measured by the digestion of fat, protein and starch and the normal development.

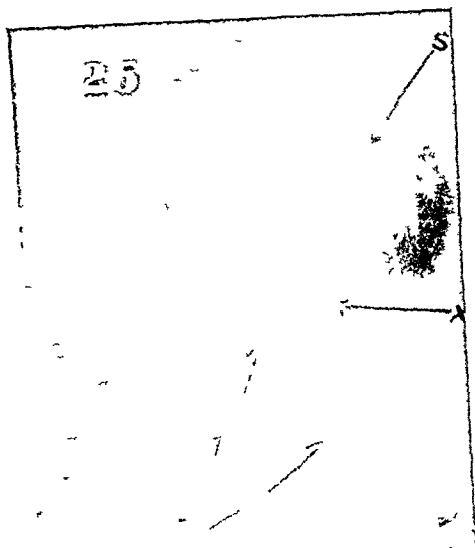
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FIG 5



Larrabee Case II X-ray of stomach containing bismuth food 4 3/4 years following a posterior gastro-enterostomy. Note the bismuth has left the stomach at 'X' the bismuth food in the intestine at 'I' S stomach I intestine 1910

FIG 6



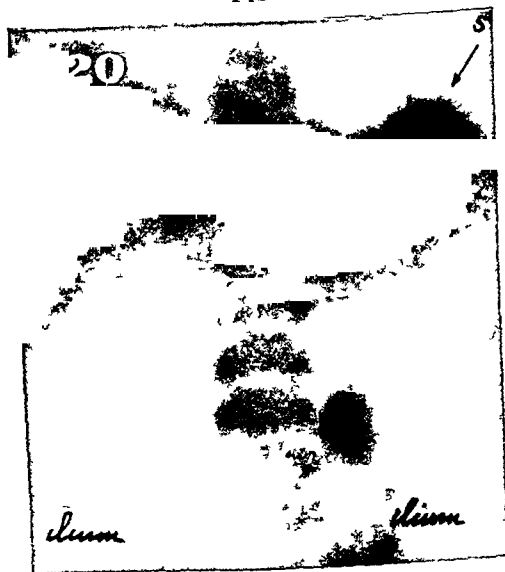
Larrabee Case II X-ray of stomach containing bismuth food 4 3/4 years following a posterior gastro-enterostomy. Note the bismuth has left the stomach as faintly shown at 'X' is the stoma S, stomach, I intestine 1910

FIG 7



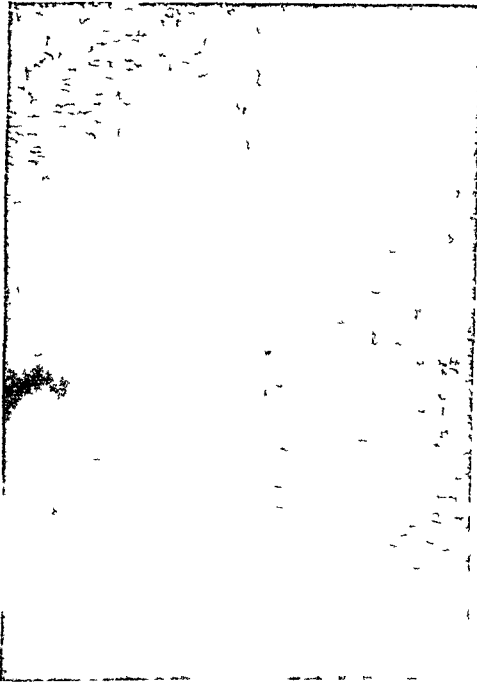
Larrabee Case II X ray of stomach containing bismuth food eight years following a posterior gastro-enterostomy 1913. No food seen going through pylorus St stomach, S stoma, I intestine

FIG 8



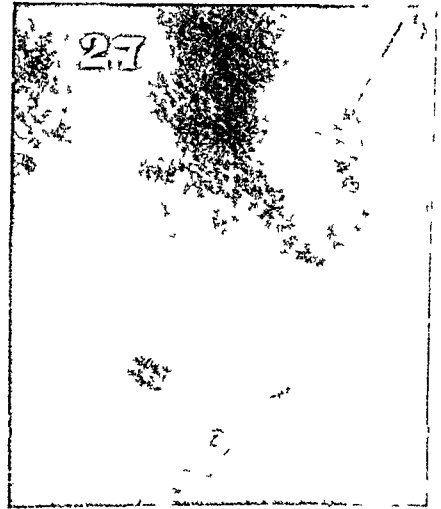
Colby Case III X-ray of stomach containing bismuth food 3 1/2 years following a posterior gastro-enterostomy. Note a later X-ray with more food in intestine and no shadow of food leaving the pylorus S stomach

FIG 1



Normal adult stomach X-ray after bismuth meal. Note that the duodenal cap and pyloric part of the stomach are to the right of the spine. X-ray, by Dodd

FIG 2



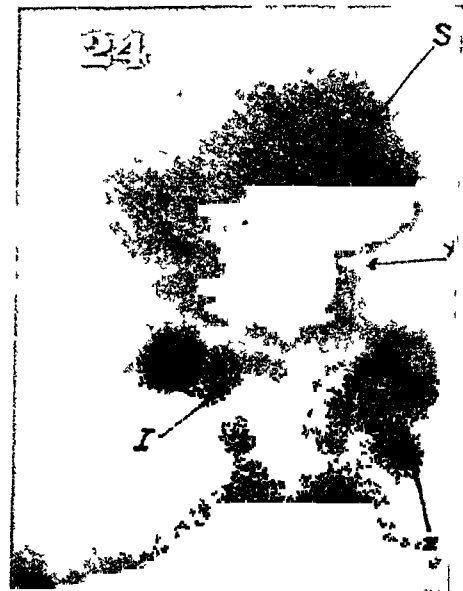
Wales Case I X-ray of stomach containing bismuth food 5 years following a posterior gastro-enterostomy. Note that the shadow of the bismuth is to the left of the median line. Bismuth is seen in the intestine. S, stomach. I, intestine. 1910

FIG 3



Larrabee Case II X-ray of stomach containing bismuth food 4 3/4 years following a posterior gastro-enterostomy. Note similar findings as those in the previous figure. S, stomach, I, intestine. X, stoma. 1910

FIG 4



Larrabee Case II X-ray of stomach containing bismuth food 4 1/4 years following a posterior gastro-enterostomy. Note the definite stoma location and food seen coming through it. No shadow of food in the duodenum next to the pylorus. S, stomach, I, intestine. X, stoma. 1910

FIG 14



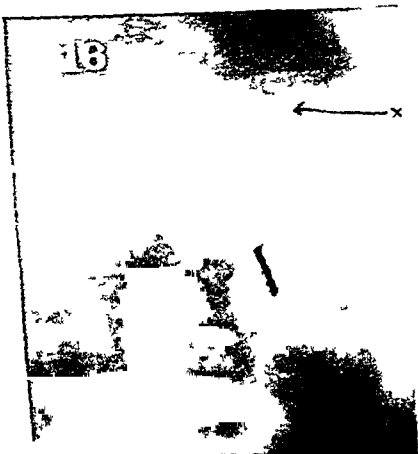
Stevens Case IV X-ray of stomach containing bismuth food five years following a posterior gastro-enterostomy 1913 Note stoma at S

FIG 16

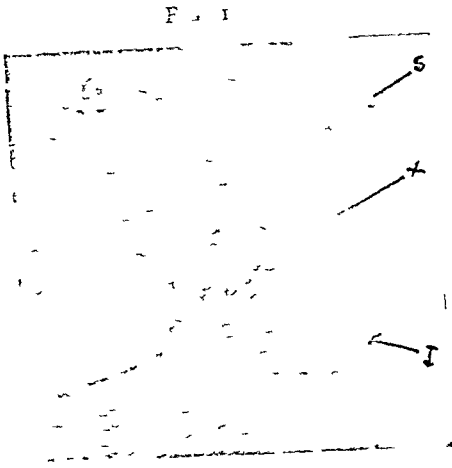


Nutting Case V X-ray of stomach containing bismuth food five years following a posterior gastro-enterostomy 1913 Note food with bismuth leaving stomach at stoma S

FIG 15

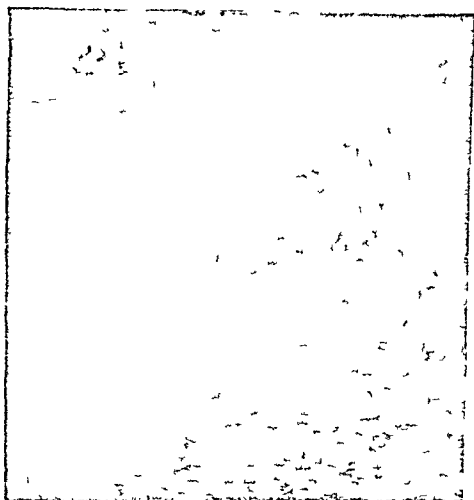


Nutting Case V X-ray of stomach containing bismuth food 1 1/2 years following a posterior gastro-enterostomy Note no shadow at pylorus and duodenum suggestion of stoma



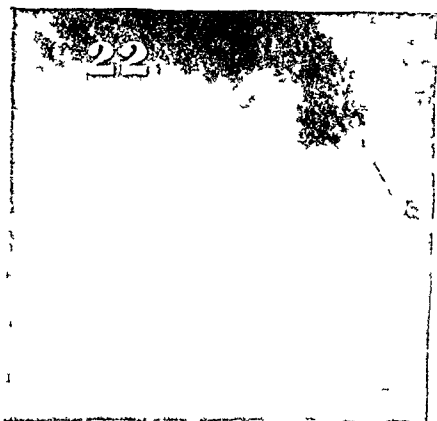
Case IV X-ray of stomach containing bismuth food 2 1/2 years following a posterior gastro-enterostomy Note shadow at stoma 'X' and intestine below S stomach I intestine 1910

FIG 9



Colby Case III X-ray of stomach containing bismuth food $3\frac{1}{2}$ years following a posterior gastro-enterostomy. Note shadow of food in intestine and no shadow of food passing duodenum. S stomach, I intestine.

FIG 10



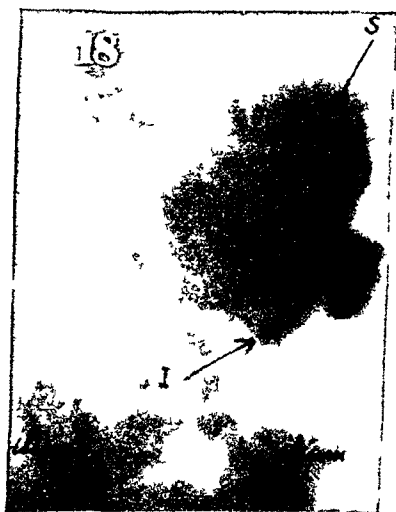
Colby Case III X-ray of stomach containing bismuth food $3\frac{1}{2}$ years following a posterior gastro-enterostomy. Note shadow wholly to the left of the median line. S stomach.

FIG 11



Colby Case III X-ray of stomach containing bismuth food seven years following a posterior gastro-enterostomy. 1913. Food not seen leaving pylorus.

FIG 12



Stevens Case IV X-ray of stomach containing bismuth food $2\frac{1}{2}$ years following a posterior gastro-enterostomy. Note shadows are all practically to the left of the median line. S stomach I intestine. 1910.

FIG 25



Case XII X-ray taken after the operation The bismuth is seen generally in the left side and middle of the abdomen after it has passed the gastro-intestinal stoma (Dunham)

FIG 24.



Case XII An X-ray taken previous to operative treatment Note the bismuth shadowy outline of the stomach and note that the bismuth remains largely in the stomach The X-ray was taken some time after the injection of the bismuth (Dunham)

FIG 26



Case XII X-ray taken a little later than Fig 25. Note the larger amount of bismuth in intestine and the indicated situation of the stoma (indicated by the arrow) (Dunham)

general condition was poor At operation a tumor was seen and palpated at the pylorus The operation was done when he was 4 weeks and 4 days old The operation was a posterior gastro-enterostomy

This boy, Oct , 1913, 3 years after operation, is well and strong and developing normally

CASE IX—Gove A patient of Dr Charles A Sturtevant, of Manchester, N H, and Dr John L Morse, of Boston The operation was done by Dr C L Scudder, June 13, 1910 A boy baby He weighed at birth $9\frac{1}{2}$ pounds He was breast fed for five weeks and gained two pounds, but had colic all the time Various formulas for feedings were then tried with indifferent success He sometimes went several days without vomiting and then vomited several feedings at a time The vomiting was occasionally explosive He just held his weight There was marked visible peristalsis A mass about the size of a lead pencil could be felt just below the right border of the ribs nearly reaching the anterior axillary line At operation a tumor was seen and palpated at the pylorus A posterior gastro-enterostomy was done when the child was five months old He is now, October, 1913, in perfect health, and is two years old

CASE X—Hills A patient of Dr MacLean, of Somerville, and of Dr John L Morse, of Boston The operation was done by Dr C L Scudder, September 11, 1910 A boy baby He weighed four pounds at birth The baby was breast fed He began to vomit when he was thirty-five days old Up to this time he had been well

Certain things are interesting in connection with this case First, the baby's vomiting began on or about the day that the mother's catamenial period was re-established It was, therefore, a question whether it being a breast fed baby the mother's milk was altered in any way to cause the vomiting Second, a definite tumor was felt in this case and the tumor was large and on the right side below the umbilicus The tumor was low and felt so large that it was a question whether the baby might not be suffering from an intussusception The stomach was known to be large Third, the *vomiting existed only four days*, which is a very short time previous to treatment by operation, as these cases go The reason for operating without the usual interval of medical experimentation is that there had been no let-up in the symptoms, and the pyloric tumor was distinctly palpable The child was 39 days old the day of the operation

divided and the appendix, in a condition of chronic inflammation, was enucleated and removed. Examination of the descending colon showed the first part of the sigmoid flexure bound down to the left brim of the pelvis by fibrous bands similar to those on the right side. These were likewise divided until the sigmoid was set normally free. The conditions as found suggested the presence at some preceding time of an infection of both tubes, consecutive to which adhesions binding down the colon had formed. This, however, could hardly have caused the peculiar membranous layer covering the posterior outer surface of the cæcum by which the appendix was imprisoned.

An uncomplicated operative recovery followed with entire relief to the abdominal and digestive symptoms. The bladder has greatly improved but still at times is irritable.

CASE XX—*General ptosis of abdominal viscera, head of cæcum covered by a pericolitic membrane which is reflected over a chronically inflamed appendix* (Hospital No 440)

Woman, thirty-nine years of age. A sallow, slender woman, who has been married two years, never pregnant. Occasionally since childhood, at long intervals, she has suffered from spells of faintness without losing consciousness, attended by vomiting and a sense of soreness through her bowels. She has always been constipated, has never had any attack of severe abdominal pain, but there is a constant sense of discomfort on the right side of the abdomen. She is practically incapacitated from active labor on account of the early exhaustion and aggravation of discomfort following exertion. She complains of indigestion, of much belching of wind. Examination shows a general ptosis of the liver, stomach, and colon. The cæcum is dilated and tender, the right kidney moderately prolapsed, and the uterus retroverted and prolapsed. Abdomen was opened by longitudinal incision from xyphoid appendix to the umbilicus. The prolapsed stomach protruded through incision. Liver was prolapsed to the level of the crest of the ileum so that the appendix and gall-bladder were in contact. The cæcum was prolapsed to the brim of the pelvis. The appendix was behind the cæcum and covered in by a pericolitic membrane. The chronically inflamed appendix was enucleated from its bed and removed in the usual manner. The raw surface left by the enucleation of the appendix was sutured to the lateral parietes near the crest of the ileum so as to fix and

the scar He was sent home on June 3, 1911, in good condition, weighing 8 pounds and 2 ounces See Figs 25 and 26

CASE XIII —Bonney A patient of Dr A O Sprague, of Turner Center, Maine The operation was done by Dr C L Scudder, on August 25, 1911 A boy baby He weighed at birth $7\frac{1}{2}$ pounds The baby was breast fed for three weeks, which was supplemented by bottle feeding He gained one pound in weight The stools were normal yellow He took his food well and did not vomit

The baby began to vomit about the time he was weaned, when he was three weeks old The vomiting was projectile and occurred some time after a feeding so that occasionally several feedings were vomited at a time The food was varied The stools were meconium-like The baby cried very little but did not sleep much At the time of the operation his weight was 6 pounds. The child was poorly nourished and so emaciated that the skin hung in loose folds on the limbs Gastric peristalsis was visible, and a hard tumor could be felt to the right of the median line A posterior gastro-enterostomy was done August 25, 1911 Death occurred at 1 19 A M, on August 26, from shock

Autopsy —The stomach and the seat of the anastomosis was removed The tumor was characteristic The stomach was slightly dilated and the stoma was patent There was no evidence of peritonitis Death was evidently due to shock

CASE XIV —Nyman A patient of Dr Nason, of Newburyport, and of Dr J L Morse, of Boston The operation was done by Dr C L Scudder, October 14, 1911 A boy baby His weight at birth in July, 1911, was 7 pounds and 14 ounces He was breast fed, supplemented with modified milk every other feeding up to the time the baby was weaned The movements were normal for the first few weeks and then became loose and green in color The movements continued the same in spite of changes in food In August he began to vomit following almost every feeding taken, and did not vomit again until the next feeding The baby was pale and weak The abdomen was somewhat distended and rather tense There was no tenderness, masses or fluid made out The liver was slightly enlarged No tumor or peristalsis was noted during observations made at times almost hourly and at times just after feedings in the Childrens' Hospital The stools were typical starvation stools The vomitus varied from 3ss to 3ii in amount, and was watery with much mucus and curds; it was once

at birth He was breast fed and seemed in good health for the first 3 weeks He increased in weight to 7 pounds and 12 ounces When he was 3 weeks old he began to vomit about an hour after each feeding The material vomited was the milk taken at a feeding The vomitus contained no bile The character of the vomiting became explosive There was a loss in weight of one-half pound in the ten days previous to the operation A pyloric tumor was easily palpable There was marked gastric peristalsis At operation a tumor was seen and palpated at the pylorus A posterior gastro-enterostomy was done when the child was five weeks old

Weight, May 18, 1910, 21 pounds The food taken was breast milk See Figs 17, 18, 19 (1910)

In May, 1913, the child's mother reported that he was perfectly well excepting that he is subject to colds

CASE VII—D H, Jr¹⁸ A patient of Drs Morse, Swain, and Dunn, of Boston The operation was done by Dr C L Scudder A boy baby His weight at birth was 9 pounds He began to vomit when he was six weeks old At that time he weighed 10 pounds and 11 oz Breast feeding was discontinued immediately and artificial feeding begun At the time of the operation he weighed 8 pounds and 11 oz The vomitus contained specks of bile The amount vomited was the whole of a feeding The stools were meconium-like Gastric peristalsis was visible A characteristic tumor was palpable At operation a tumor was seen and palpated at the pylorus A posterior gastro-enterostomy was done at 7 weeks and 4 days of age The child was in perfect health when he was 10 months and 24 days old, and weighed 20¾ pounds, May 18, 1910

In May, 1913, the mother reported that the child was perfectly well as far as his digestion was concerned

CASE VIII—W F H, Jr¹⁹ A patient of Dr Straw, of Manchester, N H, and of Dr John L Morse, of Boston The operation was done by Dr C L Scudder, April 22, 1910 A boy baby He weighed 7½ pounds at birth The baby was breast fed He began to vomit when he was 16 days old For the next two weeks he was fed a mixture of whey and modified milk, with a rectal feeding of peptonized milk every 2 hours He had occasional cyanotic attacks He had dilatation of the stomach, collapsed bowel and meconium-like movements He had lost much flesh His

¹⁸ Reported in Surg, Gynec and Obstetrics, Sept, 1910, pp 275-287

¹⁹ Reported in Surg, Gynec and Obstetrics, Sept, 1910, pp 275-287

On April 25, 1913, the mother reported the child to be perfectly well. An X-ray of the stomach was taken with bismuth and the stoma was seen to be functioning. He was 10 months old and weighed 22 pounds. The baby is now, October, 1913, over a year old and is perfectly well.

CASE XVII—Cohen. A patient of Dr. Fritz B. Talbot, at the Massachusetts General Hospital. The operation was done by Dr. C. L. Scudder, August 26, 1912. A boy baby. His birth weight was 7 pounds. The baby was breast fed the first three weeks of life and was apparently normal. The feces were normal and there was no vomiting. At three weeks old he began to vomit directly after each feeding and continued to do so up to the time of the operation. The vomiting was projectile in character. A definite tumor could be felt in the epigastrium. There was a marked loss of weight. At the operation, when he was 5 weeks old, a tumor was found at the pylorus and a posterior gastro-enterostomy was done. The baby was very weak and in spite of stimulation he died at midnight after the operation, August 27, 1912. At the autopsy the tumor was found at the pylorus and the gastro-enterostomy was intact.

TABULATION OF THE CASES OF PYLORIC STENOSIS

No	Age at operation	Duration symptoms	Time since operation	Post-operative X-rays
1	14 days	14 days	8 years	5 years, 1910 Food through stoma
2	24 days	24 days	8 years	8 years, 1913 Food through stoma
3	22 days	6 days	7 years	7 years, 1913 Food through stoma
4	25 days	11 days	5 years	5 years, 1913 Food through stoma
5	7 weeks, 5 days	3 weeks	5 years	5 years, 1913 Food through stoma
6	5 weeks	2 weeks	4 years	1 year, 1910 Food through stoma
7	13 weeks, 4 days	11 days	4 years	
8	4 weeks, 4 days	2 wks, 2 days	3 years	
9	5 months	5 months	3 years	3 years, 1913 Food through stoma
10	5 weeks, 4 days	4 days	3 years	3 years, 1913 Food through stoma
11	7 weeks	5 weeks		
12	4 weeks	4 weeks		
13	6 weeks	3 weeks	Died	
14	11 weeks	8 weeks	2 years	
15	6 weeks	2 weeks	Died	
16	14 days	14 days	1 year	1 year, 1913 Food through stoma
17	5 weeks	2 weeks	Died	

The operation was a posterior gastro-enterostomy. The child recovered well from the anæsthetic and feeding was immediately begun with a mixture of brandy and water with 1 ounce of whey. The baby took his food well until about the tenth day, when there was some vomiting and spitting up of food, which was relieved by a change in the food formula. He gained weight constantly except for one set-back and weighed 6 pounds and 10 ounces November 8, 1910. He was born on August 3, 1910, and weighed 4 pounds. The baby is now, October, 1913, three years old and is well. See Fig 20 (1913).

CASE XI—Wilson. A patient referred to the Massachusetts General Hospital from the Out-Patient Department, April 7, 1911. The operation was done by Dr C L Scudder. A girl baby (colored). The baby's weight at birth was $7\frac{1}{2}$ pounds. She was breast fed for 6 weeks but vomited continuously from the time she was two weeks old. The vomiting occurred at about 10 minutes after each feeding. There was marked gastric peristalsis visible after taking food. See Figs 21 and 22. The character of the vomiting was explosive. At the time of the operation, April 7, 1911, when the baby was seven weeks old, she weighed 7 pounds and 13 ounces. A hard tumor was palpable at the time of the operation. A posterior gastro-enterostomy was done. Following the operation there was an immediate and steady gain in weight. At the time the baby was discharged from the Hospital, May 22, 1911, she weighed 8 pounds and 2 ounces, and was in good condition. See Fig 23.

CASE XII—Dunham. A patient of Dr H A Chase, of Brockton, referred from the Out-Patient Department of the Massachusetts General Hospital to the House for operation. The operation was done by Dr C L Scudder, April 25, 1911. A boy baby. The child was given 2 breast feedings after birth which were immediately vomited. He was artificially fed from that time. No food agreed well and the vomiting was projectile. There was no bile in the vomitus and no gastric peristalsis was visible. A tumor about the pylorus could be felt which appeared to be a hard mass the size of a pea. See Fig 24. His weight at the time of the operation when he was four weeks old was 6 pounds and 7 ounces. The operation was a posterior gastro-enterostomy.

Following the operation he was given brandy in small doses, and after five hours he was given hourly feedings of milk which were retained. The baby made a steady gain. A second operation was done 24 days after the first operation for a slight hernia in

that it is accepted at the hospital as axiomatic that patients with intussusception are breast fed infants. The seasonal distribution and the preponderance of infants at the breast are rather striking in view of the common assumption that diarrhoea and irregularities and disturbances of peristalsis are largely concerned in the production of the condition. Usually the histories make no mention of symptoms preceding the acute attack; in one case it is definitely stated that there were none, one baby was subject to frequent coughs, five had diarrhoea for a few days to a few weeks, and two had more or less vomiting and diarrhoea for a month. These intestinal symptoms seem just as likely to have been due to the onset of the intussusception itself as to any preceding affection.

The acute symptoms which brought the patient to the hospital were vomiting and bloody stools. Although in two histories these symptoms are not recorded and in two others only one is mentioned, the combination is so constant as to be characteristic of the condition. The shortest period during which these symptoms were present was 12 hours, the longest 8 days. As is to be expected the duration of these typical acute symptoms has a distinct relation to the mortality rate, under both operative and non-operative treatment. With one questionable exception, death occurred in every case with a duration of four days or more—8 deaths in 9 patients—while of the patients in whom the symptoms existed one day or less, with one exception, all recovered—1 death in 7 patients—although a second one in this group succumbed later to a recurrence. In the intermediate group of 11 patients, where symptoms lasted 36 hours to 3 days, there were 6 deaths and 5 recoveries.

The examination for abdominal and rectal tumor is recorded in 24 histories. In 3, no mass could be felt in either situation, in a few it was found in one, but not the other. It is evident that the tumor might easily escape detection by abdominal examination if the abdominal wall were distended and rigid, as it sometimes was, and, of course, the rectal mass can only be found when the intussusception has progressed far enough to come within reach of the examining finger. There

bile stained, and twice stained with "old blood" The character of the vomiting was explosive always The baby lost 200 grammes in weight during the medical treatment in the hospital

On October 14, 1911, when the baby was 11 weeks old, a posterior gastro-enterostomy was done The child made a good recovery from the operation and did well Two months later, on December 20, 1911, he weighed 14 pounds

In January, 1913, the mother reported that the child had been well as far as his digestion was concerned

CASE XV—Lewis A patient of Dr C H Staples, of Malden, A boy baby At birth, September 27, 1911, he weighed 7 pounds He began to vomit October 28, 1911 There was some constipation although fecal material had always appeared in the dejections The vomiting was explosive in character and occurred every half hour There was no bile in vomitus The baby lost rapidly in weight

A posterior gastro-enterostomy was done on November 11, 1911, when the baby was about 6 weeks old A large tumor was found at the pylorus The stomach was very much distended and dilated The baby did well immediately after the operation, although very feeble He did not vomit and lived for 4 days His death was due to his previous starvation and to shock caused by the operation

The pathological specimen of the stomach and intestines showed the anastomosis in good condition, there was no peritonitis

CASE XVI—Monsen A patient of Dr Fritz B Talbot, at the Massachusetts General Hospital The operation was done by Dr C L Scudder, July 29, 1912 A boy baby His birth weight was 10 pounds He was breast fed the first week of life and appeared normal, taking his feedings well At the beginning of the second week he began to vomit everything taken, and vomited continuously up to the time of the operation when he was three weeks old His weight at this time had reduced to 9 pounds No definite mass was found in the abdomen but a firmness and hardness was apparent to the left of the epigastric region At the operation a tumor was found at the pylorus and a posterior gastro-enterostomy was done The baby did well following the operation and was breast fed He was discharged September 3, 1912, in good condition, having gained 130 grammes in 11 days

that it is accepted at the hospital as axiomatic that patients with intussusception are breast fed infants. The seasonal distribution and the preponderance of infants at the breast are rather striking in view of the common assumption that diarrhoea and irregularities and disturbances of peristalsis are largely concerned in the production of the condition. Usually the histories make no mention of symptoms preceding the acute attack; in one case it is definitely stated that there were none, one baby was subject to frequent coughs, five had diarrhoea for a few days to a few weeks, and two had more or less vomiting and diarrhoea for a month. These intestinal symptoms seem just as likely to have been due to the onset of the intussusception itself as to any preceding affection.

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INTUSSUSCEPTION †

REVIEW OF TWENTY-SEVEN CASES

BY FRANCIS OLCOTT ALLEN, Jr., M.D.,
OF PHILADELPHIA, PA

THE patients with whom this brief review is concerned were under the care of various members of the medical and surgical staff of the Children's Hospital of Philadelphia and comprise all those recognized as intussusception in that institution. The first case was admitted in September, 1897, and the last one in February, 1913, the total number in these 17 years being 27.

In the histories of these patients there is no hint of any racial or hereditary predisposition. There are representatives of the Negro, Italian, Hebrew, Russian, Irish, and other unnamed nationalities. No family histories of interest were given.

A large majority of the patients were under one year of age. All except one were under 17 months, the oldest being 3 years old, and the youngest 3 months. Seventeen were boys and 10 were girls.

It is impossible to find any definite exciting cause for the production of the intussusception. It occurred only once in July and once in August, the season when summer diarrhoea is most common, and when the largest number of cases might be expected, if diarrhoea were an important factor in the etiology. There were 5 cases in June, 5 in October, 4 in February, and at least one case in each month throughout the year. There was only one in which the history indicates that indiscretion in diet might be held responsible: a child, sixteen months old, had been weaned two weeks before the acute symptoms began, and was being fed on milk, oatmeal, barley, and rice. In 15 cases mention is made of the kind of food the baby was taking, and of these 13 were breast fed. So commonly is the patient a nursing, though the history does not always record the fact,

* Read before the Philadelphia Academy of Surgery, November 3, 1913

elevate the cæcum and descending colon. The liver was rotated upward to its normal position below the diaphragm, and its suspending ligament was shortened by pleating it with chromic gut sutures, which were inserted into the anterior parietes above the level of the costal arch. The anterior edge of the liver, at the entrance of the round ligament into the longitudinal fissure, was also included in these sutures. Similar sutures were passed, fixing the anterior edge of the liver on either side, fastening it to the diaphragm. The gastrocolic omentum and the greater omentum were then sutured to the anterior parietes above the umbilicus by a series of these chromic gut sutures arranged transversely.

At the end of six months after the operation patient reported that her bowels were acting regularly, some aperient being indicated only occasionally. All the right side symptoms had disappeared but she had had some trouble from accumulation of flatus at the splenic flexure (left-sided discomfort). Her general health has greatly improved, but she is quickly fatigued when on her feet.

CASE XXI—*Ascending and first portion of transverse colon bound together by a membranous envelope, thickened at points into distinct bands (double-barrelled shotgun arrangement), cæcum, appendix, and terminal ileum bound down to brim of pelvis by strong fibrous bands, appendix chronically inflamed, ileum knicked* (Hospital No 441)

Woman, forty-six years of age. Admitted primarily on account of menorrhagia and profuse and offensive discharge due to adenomyoma of the uterus. In addition to the pelvic condition, she suffered much from constipation and severe abdominal pain, the maximum of pain being referred to the cæcal region. Suffers much from gaseous eructations and from characteristic symptoms of fecal stasis. When admitted to the hospital the abdomen was flat and relaxed but with gaseous distention of the cæcum. The entire ascending colon and the cæcum were tender, with maximum tenderness at the site of the hepatic flexure. When the abdomen was opened, by a longitudinal incision from the pubis to umbilicus, the ascending and transverse colon were found bound together for some five inches of their course by strong membranous bands springing from the anterior surface of the omentum near its colonic attachments and inserted into the lateral aspect of the ascending colon. The cæcum and appendix were bound down to the brim of the pelvis by strong fibrous bands which involved

does not seem to be any definite relationship between the extent of the invagination and the severity of the disease. It so happened that all the patients in whom no rectal tumor was found died, and only one where the abdominal mass was confined to the right side recovered. It is probable that the extent of the invaginated bowel depends entirely upon the underlying anatomical conditions, and has little to do with the amount of strangulation and destruction of tissue. Indeed, it seems probable that the extensive intussusceptions are those which form easily on account of the great mobility of the bowel and the large size of the colon, and for the same reasons are those most easily reduced.

Of these 27 children, 20 were operated upon and 7 were not, and it is rather surprising, at first sight, to find that operation gave a mortality of about 66 per cent, while non-operative treatment gave a mortality of less than 50 per cent. Only seven of the 20 operative cases recovered, while 4 recovered without operation and 3 died. In spite of this distinctly better statistical result for non-operative treatment, a more careful consideration will show, I think, that immediate operation is always the treatment of choice. As so often happens in acute abdominal disease, other means are exhausted before operation is undertaken and, in statistical reports, the failures of non-operative measures are glossed over by the ultimate result of operation. Among these 20 operative cases, 5 are definitely stated to have been treated by enemata unsuccessfully before operation was done, and all 5 died after operation. These should be considered as non-operative failures, and it is probable that there were several more, but the records are too incomplete to identify them. In one of these 5 cases, an anal protrusion was first noted 8 days before, the patient, a boy of 8 months, was then etherized and given an enema in an attempt to reduce the invagination. This treatment failing, the child was turned over to the surgeon for a second anæsthesia and laparotomy. Death occurred 5 hours after operation. In another one, it is said that the condition had existed 5 days and several enemata had been given before admission to the hospital. At operation the

susception was easily reduced and no complications were present, the abdomen was closed without anchoring the bowel. The child did well for 4 days and had normal bowel movements. Then bloody mucus appeared in the stools and the tumor recurred. The abdomen was reopened and the invagination again reduced, this time with some difficulty on account of adhesions about the cæcum. The intestine was sutured to the abdominal wall and the wound closed. The patient again did well, but pneumonia developed and death occurred on the third day. The method of fastening the bowel to prevent recurrence varied; once the mesentery of the ileum was shortened, once an injected appendix was removed and its stump sutured to the abdominal wall, and in two other cases the peritoneum of the cæcum was sutured to the parietal peritoneum. These four patients recovered. The only fatality following an operation in which the history records this step was the case just quoted when the patient died after a second operation. This is good evidence that the procedure is not, in itself, detrimental.

Within the last month I have attempted to trace the 11 survivors of the 27 patients admitted to the hospital. Unfortunately I have not been able to find the 4 earliest ones. The other 7 have been uniformly free from symptoms of intussusception. The first was operated upon 5 years ago and has had excellent health ever since. The second was operated upon 2 years ago, developed an incisional hernia, which was repaired in another hospital a year and a half later, but has otherwise been perfectly well. The third was operated upon 17 months ago and has remained well since. The fourth had an operation 14 months ago and is still in good health. The fifth has remained well since the operation 13 months ago. The sixth passed through an attack of measles while in the hospital convalescing from operation and was well until whooping cough developed, of which the patient died 9 months after operation. The seventh was prepared for operation 8 months ago, but the symptoms having abated and the tumor disappeared, operation was held in abeyance. There has never been a recurrence and the patient is now in good health.

small intestine was found to be necrotic at the entrance to the intussusception and was excised. The patient died 22 minutes after leaving the table. In a third case an enema had been given each day for four days with no result but blood. At operation a volvulus was found in addition to the intussusception, and the ileum was gangrenous and perforated. The child died 2 hours later. Such instances as these form no basis for a plea for even a preliminary trial of enemata or other non-operative measures, but urge strongly that laparotomy be performed at the earliest possible moment. It is practically certain that all the patients who died after operation would have died without it, and it is possible that some of those who died without it might have been saved by it. As the proper execution of the injection treatment requires a fairly long anæsthesia to allow the fluid to slowly distend the colon and force back the invaginated bowel and as the danger of recurrence after reduction is a very real one, it seems hardly necessary to argue in favor of opening the abdomen during the anæsthesia and of anchoring the ileocæcal region after reduction.

The histories do not give many details of the operations. In general the abdomen was opened in or near the median line, the tumor found, and reduction attempted by making pressure on its distal end, gently forcing the invaginated portion out of the proximal end, as paste is squeezed out of a tube.

The type of intussusception found is not clearly described in many of the histories. Usually the ileocæcal region was invaginated into the colon, in one case, at least, the ileum was invaginated into the cæcum through the ileocæcal valve. In several cases serious complications were present: once a double intussusception, once a volvulus, sometimes gangrene and perforation, requiring resection and anastomosis or the leaving of the damaged gut in the wound. All of these complicated cases died. When such complications were not present and the invagination could be completely reduced, the cæcum or ileum was sometimes anchored to prevent recurrence, and, at other times, the abdomen was closed without that precaution. One case illustrates the importance of such a procedure. The intus-

on the defective anatomical arrangement. And I have wondered whether the invagination does not start in the physiological pouting of the ileocæcal valve, which may become exaggerated, on account of the laxity of the attachments of the intestine, until it is caught in the grip of the colonic peristalsis and forced onward, dragging the cæcum with it. There is only a small proportion of cases in which the ileum is found invaginated through the valve, but it may easily retract after the bulkier head of the cæcum becomes the apex of the intussusception.

Whatever the precise mechanism be, it seems probable that the formation and spontaneous reduction of intussusception is much more frequent than our records show, and that the condition occurs many times in infants who die or recover without a correct diagnosis being made. Take, for example, a history like this: seven weeks before admission, vomiting and blood in the stools, then cessation of vomiting and bloody stools, 3 weeks later treated in the dispensary for gastro-enteritis, the child doing well, later a return of vomiting and bloody stools, then a protrusion from the anus. This was almost certainly an intussusception with spontaneous reduction and a later recurrence. Another patient had vomiting and blood in the stools a month before admission, these symptoms lasting 10 days and then abating, 3 days before admission vomiting and bloody stools recurred. How many infants have had vomiting and bloody stools due to a temporary intussusception which was spontaneously cured it is impossible to imagine. Here are two who temporarily recovered, but in whom a complete cure was not effected spontaneously. These instances are sufficient to show that the condition is not one which, having started, progresses until the patient dies or is cured by treatment, but rather suggest that the anatomical defect allows of frequent invagination and reduction until the inflammatory changes hold the gut in one or the other position. The condition is diagnosed and treated only when swelling and other inflammatory reactions prevent spontaneous reduction and cause more or less

From a study of these histories and a few of the patients themselves, it seems to me that, when the diagnosis is made, there is only one treatment which is proper to pursue. That cases are cured by rectal injections is evident from this report and many others. But to secure a permanent cure by this means the reduction must be made neither too early nor too late. If made before the serous coat of the bowel is sufficiently inflamed to produce adhesions, recurrence is to be feared. On the other hand, if attempted too late, after the layers of the intestine are adherent to each other, or gangrene or perforation has occurred, the injection must necessarily fail, as illustrated by several cases in this series, and may do great damage. Immediate operation is always indicated. The only step in the operation which these cases suggest is in need of emphasis is the anchoring by suture of the ileo-cæcal region. The delayed cases with serious complications are almost hopeless from the start.

The mechanism of the production of infantile intussusception is not satisfactorily explained. The underlying factors which make the invagination possible are, of course, anatomical, and consist of unduly long mesenteries of ileum and cæcum and, perhaps, unusual disparity in the calibres of the small and large bowel, allowing the parts involved to move freely within wide limits and encouraging the entrance of the smaller into the larger segment. It is not hard to imagine that, having once entered the cæcum, the folded mass forming the apex of the invagination may be forced onward by colonic peristalsis. The difficulty is to understand how the invagination starts. The theories usually ascribe its beginning to some irritation which induces irregular or excessive peristaltic action. But there is little evidence in these 27 patients that such is the case. The increase in diarrhoeal diseases during summer does not in the least increase the incidence of intussusception and, with a few exceptions, the histories of these patients do not conform to the theory. My own impression is that the occasional preceding diarrhoea is a result, rather than the exciting cause of the trouble, and that the condition depends chiefly, if not entirely,

name by an elaborate theory based on the reactions of the parts involved to the application of lines of force, and considers them the result of the ptosed condition of the intestines. It seems to me that it is more reasonable to assume that they are the result of some such process as I have indicated. I am not aware that Dr Jackson, either, has included intussusception among the possible causes of the pericolic membrane he has described, but, if intussusception does recover, it seems almost inevitable that such a pericolitis should be one of its sequels. And, finally, a spontaneously cured cæcal invagination will account for some of the curious and almost impossible situations in which an appendix may be bound by old adhesions.

obstruction of the fecal current and hemorrhage from the congested mucous membrane

If it be so that cases of intussusception recover without intervention on our part, the cure must take place as a result of inflammatory adhesions which hold the parts approximately in their normal relations. The descriptions of the findings at operation and autopsy are too incomplete for definite conclusions, but there seem to be certain points at which the bowel remains folded upon itself longer than elsewhere—stations in the progress of the invagination—and at those points inflammation is most marked and adhesions are most likely to occur. The ileocæcal region is practically always involved. In the right-sided tumors the apex of the intussusceptum seems to be blocked by the hepatic flexure, and the inflammation is confined to the ileum, cæcum, and ascending colon. In those where the tumor runs transversely across the abdomen, the angulation at the entrance to the intussusception is in the neighborhood of the hepatic flexure, so that adhesions may form there. In the cases of left-sided tumor the angulation occurs at the splenic flexure, and adhesions may be expected there.

Assuming that some of these various forms undergo spontaneous reduction and permanent cure, it is interesting to speculate upon the conditions which may be present in after life. The mobile cæcum of the adult seems like a direct continuation of the conditions underlying infantile intussusception. If the lower portion of the ileum slips in and out of the ileocæcal valve under certain anatomical conditions in infancy, and is finally prevented from doing so by the formation of adhesions which its own pernicious activity have produced, we should expect to find in later life, within a few inches of the ileocæcal junction, bands of adhesions shortening the mesentery, and on either side of this area an unusually long mesentery permitting ptosis of the proximal ileum and the cæcum, with the production of a typical Lane's kink. I think intussusception offers also a plausible explanation for the obstructing inflammatory bands at the hepatic and splenic flexures. Mr Lane explains the formation of these bands and kinks which bear his

safer not to be too positive in the interpretation of the findings without some understanding of the symptoms exhibited. Only the modest and conservative claim is made that the methods to be described will invariably result in confirming a diagnosis already made, or in giving valuable aid to clear up a case presenting many elements of doubt.

Accompanying every inflammatory condition of the genito-urinary tract are varying numbers of pus-corpuscles and red blood-cells, and always to be seen with them are epithelia of various shapes and sizes, desquamated as the result of the inflammation and which never appear in normal urine. Upon the ability to differentiate these epithelia and to say with certainty from what part of the genito-urinary tract most of them are derived the location of the inflammatory disturbance is dependent. It is not proposed to enter into a long discussion as to the views of various authors on this disputed point. It is enough to say that the claims of Louis Heitzmann in his book on "Urinary Analysis and Diagnosis" are enthusiastically accepted by many specialists, and that these claims cannot successfully be refuted by those who offer only a refusal to acknowledge them, unaccompanied by scientific argument to sustain their opinion. Heitzmann's views are extensively quoted by most modern authors, and will be, must be, eventually concurred in by all.

By a long series of experiments, covering many thousands of cases, it has been found that epithelia of a certain shape and size appear in the urine at the inception and during the progress of certain inflammatory conditions. Careful study of the urinary sediment in cases where the clinical symptoms admitted of no doubt as to the diagnosis, led to the belief that the epithelia always found in the given disease were directly derived from the organ affected. Following these observations to their natural and logical conclusion it has been demonstrated that certain epithelia appear in certain inflammations and are never seen in normal urine. On such an argument the differentiation of urinary epithelia is based, and it should be as convincing and as susceptible of proof as the diagnosis of the clinician.

MODERN LABORATORY METHODS IN THE DIAGNOSIS OF SURGICAL DISEASES OF THE GENITO-URINARY TRACT.*

BY A. THEODORE GAILLARD, M.D.,
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THE universal tendency in modern medicine is to rely more and more upon the assistance afforded by the laboratory in the prophylaxis, diagnosis, and treatment of disease, and of all the specialties surgery is perhaps the one most in need of this aid.

In those diseases of the genito-urinary tract either distinctly surgical at the beginning, or ultimately demanding such interference, much may be learned by the clinician from the microscopist. Every surgeon when confronted with a difficult case naturally welcomes every suggestion that will aid him in arriving at a diagnosis, and the purpose of this paper is to call attention to methods that are of distinct value if pursued with persistent care and careful attention to detail. The various pathological and bacteriological tests long ago accepted as conclusive, and concerning which there is no dispute, will not be referred to, but I wish to emphasize as strongly as possible the value of a properly conducted microscopical examination of the urine. In nearly every disease of the genito-urinary tract the urine offers to the trained eye more diagnostic information than can be learned by any single manifestation or any group of subjective symptoms. Carrying with it as it does unmistakable evidences of the source, severity, character, and comparative duration of the inflammation, there remains only the necessary time and care in its examination to yield definite and conclusive results. That a trust-worthy diagnosis may be made without previous knowledge of the age, sex, or clinical history of the patient is undoubtedly true, but ordinarily it is

* Read by invitation before the Philadelphia Academy of Surgery, November 3, 1913

The importance of careful X-ray study must be given great emphasis, and of course a positive shadow offers reliable information as to the presence and location of the stone, but as about 75 per cent of all calculi are composed of uric acid the findings are frequently negative or doubtful. Examination of the urine in these cases will often clear up the diagnosis, and the microscopical picture will vary with the extent and duration of the inflammation. Some observers lay great stress upon the presence of a moderate or large number of red blood-cells in the urine, but if the source of the trouble is to be positively determined they must be accompanied by characteristic epithelia from the kidney, and ureter. Crystals of uric acid gravel in large numbers, particularly the rarer forms of stellate and needle-like concretions, together with renal epithelia, pus-corpuscles, and red blood-cells, offer, if not positive evidence, at least a strong possibility of the presence of a stone.

Suppurative pyelitis caused by calculus in the pelvis of the kidney, may be diagnosed by the above features, accompanied by a large number of pus-corpuscles and the presence of a preponderating number of epithelia from the pelvis of the kidney and the ureter. The former (pelvic epithelia) are characterized by round, oval, or lenticular shapes, are much larger than those derived from the kidney, while smaller than those of bladder origin, and the latter (ureteral epithelia) are usually round and twice the diameter of the pus-corpuscles.

Strongly suspicious of calculus in the pelvis or an impacted stone in the ureter is the sudden change from features pointing markedly in that direction to an almost complete absence of the same. This calculous anuria is by no means uncommon, and the features shift from time to time as the urine flow is obstructed or released. I saw this beautifully illustrated not long ago in a case operated upon by a prominent surgeon of this city. I had the privilege of following the case for some time before operative interference was decided upon. Repeated X-ray examinations always produced a shadow on the left side three inches above the bladder, and the ureteral catheter was arrested at that point. The microscopical picture of a

in a case of pneumonia, where long observation of the symptoms manifested allow of no hesitancy in the verdict

At this point it should be understood that the claim is not made to label by a specific name every single epithelium appearing in the urine, but any inflammation of sufficient intensity to produce clinical evidences will result in the desquamation of a number large enough to warrant positive opinion as to their source. Many cases naturally present the difficulty of multiple involvement, necessitating careful study, but the embarrassment, if temporary, is never unsurmountable, the comparative number of the various epithelia present offering a sure guide as to the organ most affected

It is hardly necessary to state that of all the epithelia found in urine those derived from the kidney are of the greatest practical significance, and fortunately at the present time there exists no difference of opinion as to the certainty with which they may be recognized. Many authors persistently refused even this concession until the study of specimens obtained by ureteral catheterization proved conclusively that these epithelia, always of a definite shape and size, appear in all diseases of the kidney. From the convoluted tubules the shape is round or oval, and in size one-third larger in diameter than the pus-corpuscle. Of about the same size, only columnar in shape, are those derived from the straight collecting tubules, and their presence in moderate or large numbers is usually indicative of a severe inflammation

By reason of their importance, and for convenience of description, surgical diseases of the kidneys will be considered first, and perhaps one of the commonest is calculus. According to Keyes calculus in the kidney or its pelvis is the most frequent cause of renal suppuration, but I cannot agree with this author when he adds that "catarrhal inflammation is not encountered with calculus." As is well known to the clinician the symptoms vary greatly—all the way from an almost complete absence of subjective signs to a combination of intense renal colic, pressure and reflex pains, hæmaturia, and finally, suppuration and abscess

possible calculus was not as pronounced as is sometimes depicted in these cases, but my diagnosis of calculus was based on the fact that the features appeared and disappeared at intervals, two specimens in one day showing totally different findings. The patient was operated upon, extensive incisions being made, the bladder opened, and no stone found. Three weeks later he had another attack of renal colic, returned to the hospital and acted as his own surgeon by passing a stone so large that meatotomy was necessary for its final delivery.

Another important factor in the diagnosis of renal calculus is the appearance of the epithelia when the pressure of a foreign body exerts itself, or hypertrophy of the organ affected is co-existent with other symptoms of inflammation. This pressure results in the production of so-called endogenous new formations or inflammatory corpuscles within the epithelia, and these formations are never present in large amount except in pressure of some kind.

Pyonephrosis of tubercular origin offers in the urine both macroscopic and microscopic points of diagnostic value. The urine is usually heavily turbid, and if allowed to stand the pus separates itself into a thick creamy layer at the bottom of the glass, the supernatant fluid being clear. This is in marked contrast to the persistently turbid appearance of urine voided in ulcerative cystitis, or the residual urine in a case of prostatic hypertrophy where the bacteria of decomposition will not allow of such a separation.

At first glance it would seem that the clinician should not long remain in doubt over a suspected case of renal tuberculosis, but there are many where the family and personal history, and the objective and subjective symptoms offer little or no help. Particularly difficult is the diagnosis between renal tuberculosis and an ascending colon bacillus infection. Often the only prominent feature is pyuria, and the laboratory is invoked to ascertain the cause. Search for the tubercle bacillus, while so often unproductive, often fails because the proper technic is not observed. The urinary sediment should be as concentrated as possible, obtained first by sedimentation, then by the

also the last two inches of the ileum Hidden beneath this cæco-iliac membrane was the appendix in a state of chronic inflammation The bands were divided and appendix enucleated and removed and the raw surface covered over by peritoneum Two large cysts of the left ovary were excised Uterus removed in the usual manner. Patient made an uncomplicated recovery Her health thereafter became markedly improved She gained steadily in strength and spirits and was relieved of all troublesome symptoms

CASE XXII — *Ptosis of stomach, cæcum and ascending colon covered by membraniform veil, which at the hepatic flexure was thickened into a distinct band constricting the hepatic flexure, appendix chronically inflamed, from meso-appendix a band-like reflection passing to ileum and angulating it (ileac kink)* (Hospital No 451)

A female, sixteen years of age A bright, active young girl, who from early childhood has suffered from frequent abdominal crises of pain, vomiting, and diarrhœa An especially aggravated attack occurred six months ago When she was eight years of age she had a continued fever for a period of six weeks, since which time her general malaise dates Her bowels are constipated, menstruation regular Examination reveals a narrow lower thorax and upper abdomen and a large lower abdomen and hips, giving the general conformation of an hour-glass There is ptosis of the stomach The cæcum is distended and tender. Marked tenderness over the appendix

Abdomen was opened by longitudinal incision through the right rectus muscle Over the cæcum and ascending colon there was a delicate, congested, membraniform veil This was thickened as it approached the hepatic flexure and formed a constricting band which bound down and diminished the lumen of the colon at that point The appendix was not covered over by the membrane, but was elongated, thickened, and congested, lying down upon the brim of the pelvis From the meso-appendix there was a reflection which passed over on to the ileum angulating it (ileac kink) The appendix was removed. The ileac reflection of its meso was divided and the ileum freed; the pericolic band which constricted the hepatic flexure was divided, the ptosed transverse colon was fixed to the anterior abdominal wall above and to the right of the umbilicus by two points of chromic gut suture The

refer with great emphasis to the extreme importance of obtaining by the ureteral catheter specimens from both kidneys so that both may be studied before surgical relief is attempted. The reasons are obvious, (1) to avoid the catastrophe of removing one kidney in the congenital absence of the other, (2) to ascertain positively whether the disease is unilateral or bilateral; (3) to estimate through the chemical and microscopical findings the degree of functional activity exhibited by one or both kidneys.

Estimation of the renal function has been attempted by means of chemical tests over and over again, each new process attracting for a time more or less enthusiastic attention, but one after the other all have been discarded as practically valueless. Cryoscopy, always cumbersome in the technic, has been proven entirely worthless, as in many cases where one kidney known to be badly diseased and the other performing the functions of both, it has been shown that the freezing-point varied little or not at all. Much was expected of the numerous forced elimination tests with urea, sodium chloride, water, and the dye-stuffs, but the consensus of opinion now is that they are of no value in estimating the functional activity of the kidneys. The injection of phloridzin, setting up an artificial diabetes, with the appearance of sugar in the urine in about one-half to one hour in normal kidneys, and its failure of elimination in nephritis indicates only that the renal function is somewhat disturbed, and the results are never uniform. More promising in its accuracy than any other is the phenolsulphonephthalein test, recently devised by Rowntree and Geraghty, but it can hardly be carried out by the general practitioner, and even in the laboratory involves the employment of much time and work to obtain results more easily arrived at in other ways. These tests have been briefly referred to only to be condemned, for it is difficult to understand why time should be wasted on them when microscopical examination affords such positive proof of all that we desire to know regarding renal sufficiency or insufficiency. As already stated the urine from each kidney must be collected by the ureteral

added power of the centrifuge, and many slides should be examined before the search is abandoned and the findings declared negative. The next procedure is usually the inoculation of a guinea pig, this of course frequently making the diagnosis positive, but even before these methods are indicated by the gravity of the case, microscopical examination of the urine will often yield valuable information, at least in pointing the finger of suspicion toward a possible tubercular process. Tubular casts are sometimes present, though not often, the chief features being a large number of pus-corpuscles, few red blood-cells, connective-tissue shreds, fat globules free in the field and studding the epithelia, and epithelia from the convoluted tubules, straight collecting tubules, and pelvis of the kidney.

A clue of great value is supplied by the appearance of the pus-corpuscles, which in a tubercular infection indicate with unfailing accuracy an impaired constitution. This diagnostic point was first announced and demonstrated by Carl Heitzmann and one has only to study a sufficient number of cases to be convinced of its soundness and practical value. Pus-corpuscles indicative of a good constitution appear in freshly voided urine as coarsely-granular, rather highly-refractive cells with no visible nucleus. As the constitution becomes impaired the granulation appears finer, the refraction diminishes, until finally the regular contour is lost, the edges are ragged, and one or more nuclei come into view. A combination in a given case of two or more of the varieties described, for example, a number of coarsely-granular, highly-refractive corpuscles in company with others of pale, finely-granular, irregularly-shaped, nucleated appearance would indicate an originally good constitution now impaired by disease. Because I have touched upon this point while discussing tuberculosis it must not be understood that its diagnostic value is applicable only to this disease. The same information is at our disposal in any inflammation of the genito-urinary tract of sufficient severity to produce pus-corpuscles in numbers large enough for comparative study.

Before leaving the subject of renal tuberculosis I wish to

ceptible of positive diagnosis until the ulcerative process has begun, but when desquamative shreds of the tumor are voided in the urine no difficulty should be experienced. What has been said of sarcoma and cancer of the kidney applies equally to similar growths in the bladder. Hæmaturia is one of the first and most prominent symptoms, and even before the disease has advanced to the stage where connective-tissue shreds, sarcoma and cancer corpuscles, and evidences of a chronic inflammatory process contribute to a positive conclusion the characteristic bladder epithelia are always present. With the exception of those from the vagina, bladder epithelia are the largest seen in urine. From the upper layer, a few of which appear in normal urine, the shape is the familiar pavement or squamous form. This changes to a spherical or oval contour (from the middle layer) when the inflammation becomes more intense, and the columnar variety (from the deepest layer) is the product of deep-seated infection or ulceration. In diseases of the bladder, as of the kidney, prostate, or any other part of the genito-urinary tract, the location of the inflammation and the ultimate diagnosis are absolutely dependent upon the differentiation of the epithelia always accompanying the other features in the case.

Papilloma of the bladder should especially be mentioned, because of its comparative frequency, and the striking microscopical evidences in the urine when this benign tumor is present. Hemorrhage, of course, is a prominent symptom, sometimes so profuse as to obscure more or less the other features, but rarely absent are the peculiarly-shaped connective-tissue shreds, once seen never forgotten, and of themselves almost pathognomonic. These shreds are very long, very irregular, having a tendency to coil or knob-like formations, and frequently contain fat globules or inflammatory corpuscles. With these features are pus-corpuscles and epithelia from the various layers of the bladder, particularly the columnar, many of them containing fat globules and the endogenous new formations indicative of pressure.

Intimately associated with the bladder is the prostate gland,

catheter, simultaneously and for the same period of time. Chemical and microscopical examination of the two specimens will indicate conclusively the extent and location of the disease, and the constitution of the patient being determined at the same time by a study of the pus-corpuscles, the surgeon has at his disposal all the information necessary to a prompt decision as to the advisability or contra-indication of operation.

Malignant disease of the kidneys may often be diagnosed by microscopical examination of the urine, and aids the surgeon considerably when the clinical symptoms are either vague, or confused by the severity of some co-existent infection.

Sarcoma may occur at any age, and at its inception, before the ulcerative process is established, is difficult of diagnosis. To admit of a positive opinion there must be present in the urine large masses or shreds of connective-tissue and the characteristic sarcoma corpuscles in large numbers. Connective-tissue in the urine does not receive the attention it deserves, probably because it is so often confounded with mucus or extraneous matters such as cotton and linen fibres. It consists of wavy, moderately-refractive fibres, having a tendency to form into bundles, and is found in ulcerative, suppurative, hemorrhagic, and traumatic inflammations. Especially marked in ulcerative processes of malignant origin, these shreds, filling as they sometimes do an entire field, and studded as they occasionally are with inflammatory corpuscles, are enough of themselves to warrant a diagnosis of malignant tumor. In combination with sarcoma corpuscles, which present the appearance of small, round, highly-refractive, even glistening cells, without nuclei, larger than red blood-corpuscles and smaller than pus-corpuscles, the diagnosis of sarcoma is positive.

Cancer of the kidney is difficult of diagnosis from the urinary findings alone, but when large masses of connective-tissue, filled with large multi-nucleated epithelia are seen, accompanied as sometimes occurs by typical cancer nests, the suspicion of cancer is usually confirmed by the ultimate clinical history of the case.

Surgical diseases of the bladder due to tumor are not sus-

the bladder itself are always present, as there is naturally an accompanying secondary cystitis

It follows logically that this bacterial invasion and infection of the bladder cannot be long continued without an extension of the process through the ureters into the kidneys, and many cases of pyelonephritis are of such origin. This possibility, at times a dangerous complication of prostatic hypertrophy, necessitates careful study of the urine before operation is advised or attempted. Too many of these cases die shortly after operation, the mortality being ascribed to any but the real cause, *i e*, functional insufficiency of the kidneys. There should be no difficulty in making the diagnosis, and at the same time the surgeon is accurately informed as to the resistance apt to be exhibited by the patient.

The prostate is at times the seat of malignant disease, and such a diagnosis is made in the same manner as previously described when the kidney or the bladder becomes the host of this unwelcome visitor.

Stricture of the urethra presents a typical urinary picture, but is of no practical importance, as the clinical symptoms are clear, and routine examination by the surgeon leaves no doubt as to the diagnosis.

In conclusion I must ask your indulgence for the necessarily rough outline of the subject presented. Its importance is vital enough to deserve better and more detailed treatment, but I hope I have sufficiently accentuated the need of employing every modern laboratory test in the diagnosis of surgical diseases of genito-urinary origin, and the absolute necessity of determining before operation the functional power of the kidneys by microscopical examination of the urine.

and diseases of this organ requiring surgical interference are common enough, and the diagnosis at times sufficiently obscure to demand whatever assistance the laboratory affords. Acute and chronic prostatitis, usually gonorrhoeal in origin, seldom necessitates actual surgical aid, but abscess formation is of frequent occurrence and often goes unrecognized until rupture occurs. The diagnosis of such a condition is dependent upon the presence in the urine of a large number of pus-corpuscles, sometimes entirely filling the field, connective-tissue shreds, red blood-corpuscles, and epithelia from the prostate gland and its duct. These epithelia are about twice the size of pus-corpuscles, larger than those from the convoluted tubules of the kidney, and cannot be differentiated from those of ureteral origin, which are of the same shape and size. In prostatic abscess, however, the bladder and urethra are also involved, and the presence of epithelia characteristic of these organs will easily locate the inflammation, as in renal disease epithelia from the convoluted and straight collecting tubules and pelvis of the kidney enable us to eliminate the prostate as entering into the situation. The diagnosis of the majority of prostatic inflammations is rendered more simple by the presence in many cases of epithelia from the seminal vesicles and ejaculatory duct, but their surgical importance being negligible detailed description of them is omitted.

The urine in prostatic hypertrophy, especially of the senile type, presents another opportunity for positive diagnosis, oftentimes extremely valuable in hypertrophy of the so-called median lobe which has escaped the touch of the surgeon's examining finger. When the condition has reached the stage where urinary flow is obstructed and residual urine is always present, the bacteria of decomposition, of course, point strongly toward the prostate as being responsible. The epithelia from the prostate in such a case are always more or less filled with fat globules indicating chronicity, and endogenous new formations due to pressure of the enlarged gland. Epithelia from the neck of the bladder and those from the deeper layers of

FIG 1



Infiltration of J11 and J12 at 1000 psi

A TECHNIC FOR PERFORMING A SHOCKLESS SUPRAPUBIC PROSTATECTOMY.

BY W. E. LOWER, M.D.,

OF CLEVELAND, OHIO

THE shock-producing factors of a prostatectomy are first, the effect of the anæsthetic, second, the *amount* of painful traumatism, and third, the hemorrhage. In so far as any of these factors can be minimized, post-operative shock will be lessened, if they can be eliminated then the operation becomes shockless and may be performed without hesitancy upon patients who, because of their age or because of diminished vitality from any cause, have been considered bad operative risks.

After a considerable experience and the trial of many different methods to diminish the dangers of this operation, the following technic has been evolved. Patients undergoing a prostatectomy performed by this technic are not only free from shock but are in splendid condition to combat any other untoward influence that may arise during convalescence.

TECHNIC

1 An hour before the operation the patient is given a hypodermic injection of morphine and scopolamine, the size of the dose depending upon his age and condition.

2 Immediately before the operation the bladder is irrigated and 60 to 90 cc of a 5 per cent solution of alapin is injected through a catheter, the catheter is clamped, and both catheter and solution are allowed to remain.

3 Nitrous oxide-oxygen is administered by an expert anæsthetist, this anæsthetic when administered by one trained in its use being safer than ether and to some extent in itself a preventive of shock.

4 The bladder is approached in the usual way, except that the skin incision and every division of tissue is preceded by a thorough infiltration with novocaine in 1-400 solution (Fig 1)

wound was closed without drainage. Immediate operative recovery without complication.

The relief of abdominal symptoms which immediately followed the operation was not permanent. Six months later, when examined, obstipation was present in as great a degree as ever, with a good deal of distress in the region of the transverse colon and the splenic flexure. A marked degree of pylorospasm was present. Further medical treatment has been instituted. In the event of its failure to relieve an ileosigmoidostomy may be considered.

CASE XXIII—Marked membraniform layer covering and binding together ascending colon and first part of the transverse colon (double-barrelled shotgun arrangement), at the hepatic flexure a band-like development in the membrane constricting the gut, appendix not covered by membrane but in condition of chronic inflammation (Hospital No 462)

Woman, twenty-two years of age. Well developed, always well until six months ago, when after the birth of her first child she began to suffer from constipation with much distress, due to accumulation of flatus in the colon, particularly in the region of the cæcum. Eight weeks ago had acute appendicitis. Much vesical irritation. Upon examination she had marked tenderness over the appendix, with discomfort on pressure over the region of the hepatic flexure. Urine full of colon bacilli. X-ray-bismuth examination showed dilatation of cæcum and ascending colon, marked angulation at the hepatic flexure, with first part of transverse colon running parallel to the ascending colon for about four inches (double-barrelled shotgun arrangement).

Abdomen opened through the right rectus muscle exposed a marked membraniform layer covering the ascending colon and the cæcum and the first portion of the transverse colon, binding them together in the position previously demonstrated by the X-ray examinations. That portion of this membrane which covered the hepatic flexure was more strongly developed, forming a band markedly obstructing the lumen of the colon at that point. This band and the remaining portion of the membraniform veil were divided and reflected until the bowel was liberated and fell into its normal position. The thickened and chronically inflamed appendix was removed. Patient made an uncomplicated operative recovery. Three months after operation she reported that her bowels were moving normally from one to two times daily and that her general

Infiltration of bladder wall with novocaine

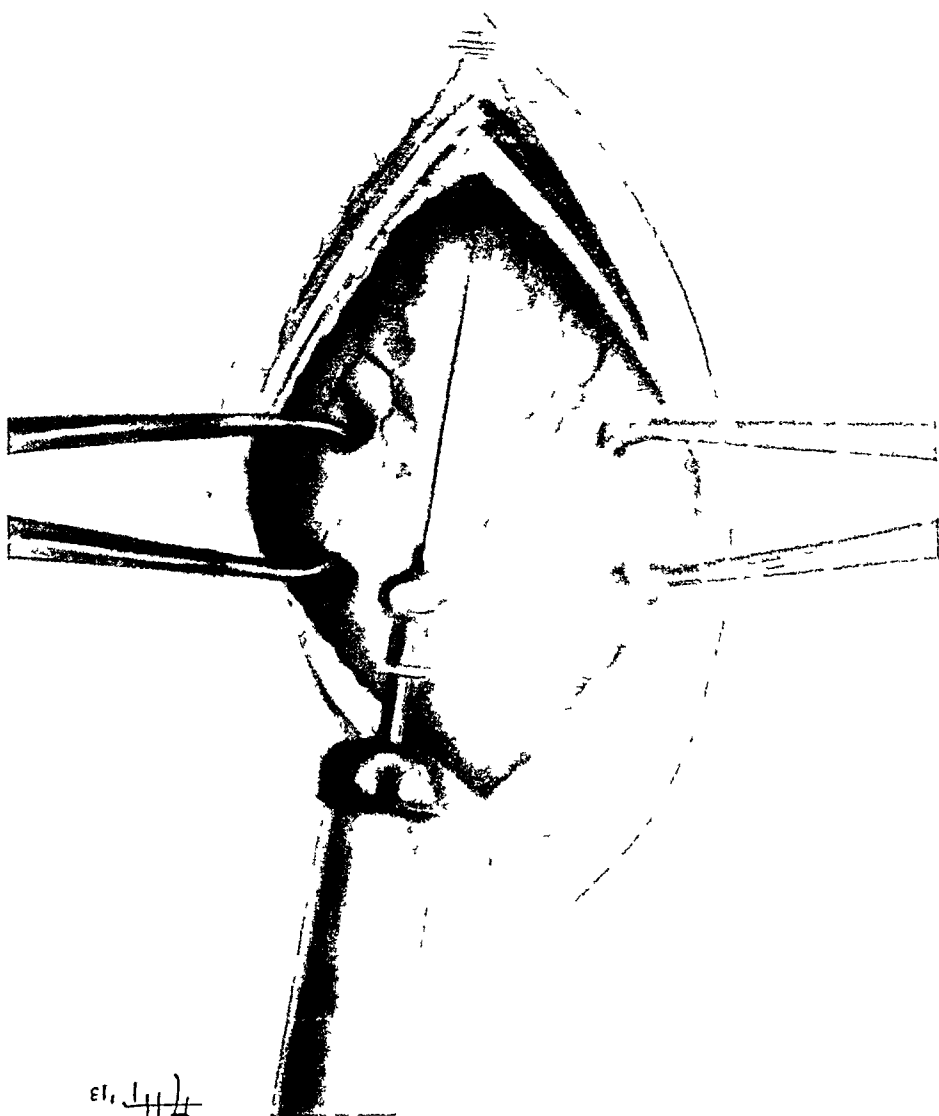
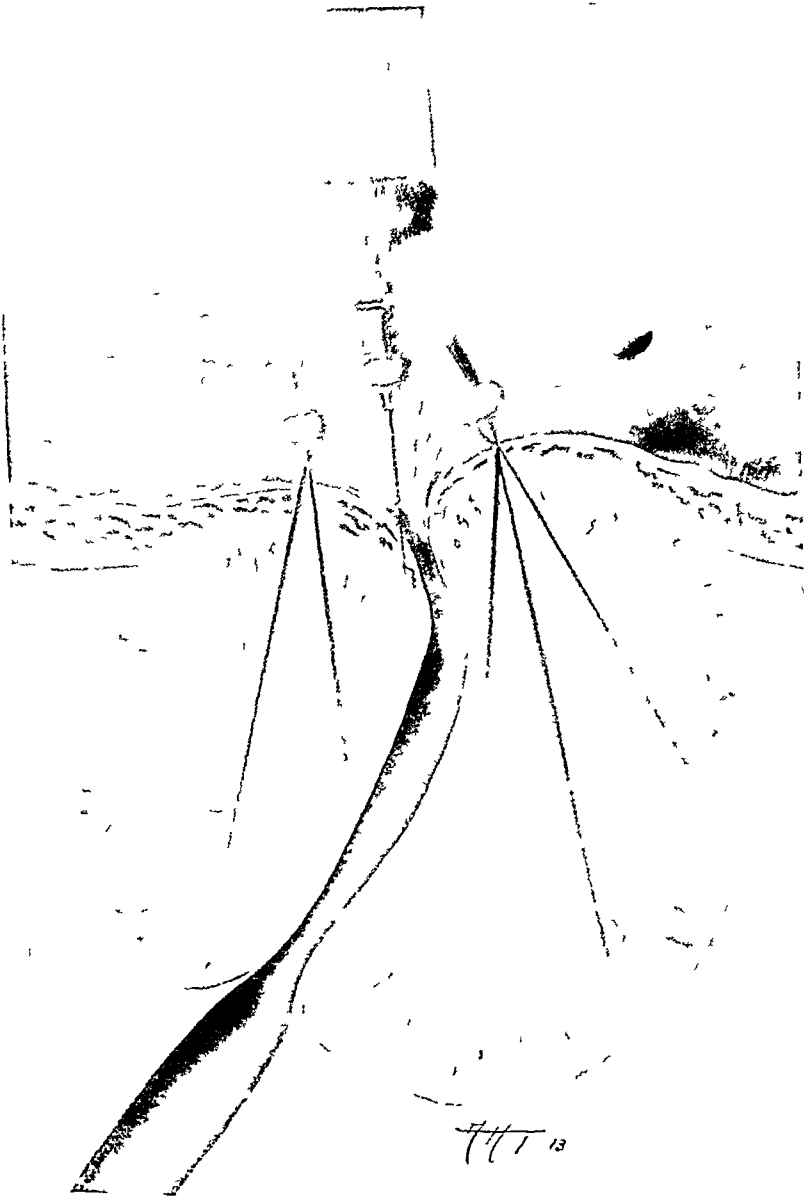


Fig 2.

7/17/13

FIG 4



Deep infiltration along edge of capsule of prostate before removal



7/11

Intravaginal exposure of prostate

FIG 6.



Gauze packing by which the raw surfaces of capsule are brought in apposition

FIG 5



Cavity left after enucleation of prostate

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, held November 3, 1913

DR JOHN H GIBBON, Vice-President, in the Chair

ARTHROPLASTY FOR ANKYLOSIS OF ANKLE

DR ASTLEY P C ASHHURST presented a boy, aged eight years, who caught his right foot in the machinery of a grist mill, two years before coming under observation. Most of the soft parts on the inner side of the foot and ankle were torn away exposing the bones. Subsequently there was a great deal of sloughing, infection extended up the inner side of the leg nearly to the knee, and the boy was completely disabled for a long time. Part of the third toe was lost. On June 15, 1913 he was brought to the Orthopædic Hospital and admitted to Dr Harte's service. The wounds had only recently healed there were long scars densely adherent to the underlying bones all along the inner side of the foot and ankle, and up the inner surface of the leg almost to the knee. The foot was in a position of equinus, at 140 degrees with the leg, and there appeared to be bony ankylosis at the ankle (Fig 1). This supposition was confirmed by a skiagraph, which showed ankylosis also of most of the tarsal bones, all bony outlines being obliterated (Fig 4). The boy walked on the toes with the foot in a position of marked equinus and slight varus, and with the great toe in marked hallux valgus deformity (Fig 5). There was nothing but scar tissue on the inner side of the foot and ankle, and this was densely adherent to the bone, absolutely no soft tissues being left. Careful and skilful massage was given for over seven weeks, but though some improvement occurred in the nutrition of the skin most of the cicatrices remained densely adherent to the bones. At length operation was decided on, and it was planned by Dr Ashhurst to excise a wedge of bone of sufficient size to bring the foot up to

5 When the bladder is exposed, it is elevated with curved bladder hooks and the bladder wall is thoroughly infiltrated with the novocaine solution (Fig. 2)

6 By gentle retraction and without injuring the cut edges of the bladder wall, the prostate is exposed intravesically (Fig. 3).

7 The bladder mucosa on the projecting prostate is infiltrated with novocaine, and along the edge of the capsule a deep infiltration is made (Fig. 4)

8 With careful and most gentle manipulations the prostate is enucleated with the finger (Fig. 5).

9 Narrow strips of gauze are packed along the side of the catheter on top of the mucous membrane so that the raw surfaces of the capsule are brought in apposition, a procedure which effectively prevents hemorrhage (Fig. 6) The two ends of the urethra are thus brought together, so that a continuous funnel-shaped mucous membrane is produced—a most important factor

At the close of this operation the color of the patient will be good, the pulse and respiration will not be increased, in fact, may be even lower than before the operation The patient will rest comfortably, will be free from nausea and mucus, can take water early, and a speedy, uninterrupted convalescence may be looked for

FIG 4

1 1
3



X ray of ankylosis of ankle joint in position of equinus

101



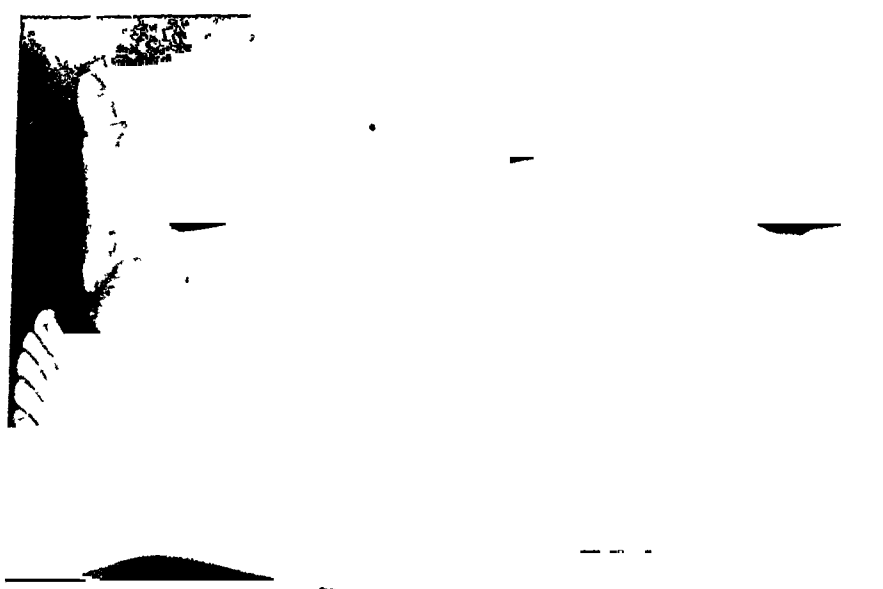
Ben
relative of ankle-joint in position of equinus (190°)

102



Showing external incision for arthroplasty of ankle

103



Result of arthroplasty of ankle



X ray showing result of operation for hallux valgus

FIG 7



X-ray showing lateral view of foot after arthroplasty of ankle-joint. In lateral view the new joint can be seen a short distance below the epiphyseal line of the tibia. In the anteroposterior view it can scarcely be seen.

FIG. 5



X-ray showing number of holes in object

a right angle with the leg, and then, if it had been found possible to preserve the lateral ligaments, so as to ensure stability of the foot on the leg, to transplant a piece of fascia lata between the bones, thus providing for motion at the ankle-joint. The loss of the subastragalar joint is much less disabling than that of the ankle-joint, and even in performing an arthrodesis of the ankle-joint in cases of infantile paralysis it is better to secure firm fibrous rather than actual bony ankylosis, so as to promote locomotion.

Operation, August 7, 1913: Dr Ashhurst Ether. Esmarch band above the knee. An incision was made on the outer side of the tarsus from below the external malleolus forward above the peroneal tendons as far as the extensor tendons (Fig 2). This incision was carried to the bone, and all the soft parts were raised from the bones across the dorsum of the foot and ankle. Another incision, about an inch in length, was then made on the inner side of the ankle-joint, just in front of the internal malleolus and parallel to the shaft of the tibia. This incision had to pass through the old cicatrix adherent to the bone. The inner and outer wounds were then joined by burrowing from one to the other between the bones on the dorsum of the ankle and the overlying soft parts, thus raising all extensor tendons and the anterior tibial vessels out of harm's way. Next a wedge of bone was cut out by means of osteotome and gouge, the wedge had its base on the dorsum of the tarsus, and its apex at the posterior surface of what used to be the ankle-joint. After this wedge was removed, and the foot rendered movable on the leg, the next task was to excavate the tibio-fibular mortise. Then the foot came up to a right angle with the leg. Having preserved the lateral ligaments it was now found that there was only slight lateral mobility and tendency to valgus deformity (there had been varus deformity previously); therefore, it was determined to insert a flap of fascia lata so as to preserve the motions of the ankle-joint. Owing to the dense cicatrices all around the ankle and foot there was no possibility of employing a pedunculated flap. Accordingly an incision was made over the left thigh, and a piece of fascia lata and muscle was cut free at the point where the tensor fasciæ femoris is inserted. This transplant was two inches square and about one-quarter of an inch thick. The transplant was then placed in the new ankle-joint, and stitched in place with chromic

condition was excellent. She has, however, had several attacks of pyloric spasm relieved by vomiting. Still has occasional frequency of urination.

CASE XXIV — *Cæcum bound down by dense membrane which covered in the appendix, band extending from appendix to ileum, which was constricted by it* (Hospital No 467.)

Woman, fifty-eight years of age. Since birth of her child 35 years ago has suffered from frequent spells of so-called stomach trouble, characterized by acute cramping pain in the right upper abdomen accompanied by vomiting. These attacks would last from a few minutes to some hours. Has been icteroid, but never distinctly jaundiced. The attacks were always followed by marked tenderness in the right hypochondrium. In the intervals between these attacks she suffered from epigastric distress after meals, with frequent vomiting, much flatulent belching and bloating.

Right rectus incision exposed the cæcum bound down by a dense membraniform cover which included the appendix and bound it to the mesentery of the ileum, causing a constriction of the ileum one inch proximal from the cæcum. The constricting band binding down the appendix was divided, loosening the ileum, and the appendix itself was dissected out from its covering and removed. The pericolic membrane was divided and reflected. Passing to the hypochondriac region a greatly dilated duodenum and a chronically inflamed gall-bladder bound together by extensive adhesions were exposed. No ulcer of stomach or duodenum. Duodenum separated from gall-bladder. Gall-bladder brought up into wound, opened, and 17 gall-stones removed. Tube drainage of gall-bladder established. Balance of wound closed by layer sutures. Uncomplicated operative recovery.

CASE XXV — *Cæcum and ascending colon covered and bound down by strong membranous bands, upper portion of which constricted hepatic flexure; appendix chronically inflamed, liver and stomach prolapsed, duodenum dilated and adherent to gall-bladder* (Hospital No 479.)

A woman, forty-four years of age, who always had trouble with her stomach. Two years ago had an attack of severe pain in the epigastrium, confining her to bed for some days. Thereafter she was subject to attacks of pain in the epigastrium, which would come on about two hours after eating and would be relieved by

The plaster case was removed October 23, three weeks after operation. There was a little sloughing of the margins of the flap over the metatarso-phalangeal joint of the great toe, but the other incisions were firmly healed, and the deformity was almost entirely overcome (Fig 7). Passive motion was instituted, and the boy encouraged to walk around. Examination November 1, 1913, showed that he had free voluntary motion in the ankle from 85° to 95° , and that passive motion was possible from 85° to 110° .

The patient was shown at this meeting, Dr Ashhurst said, because he would leave for his home in Maryland before the next meeting. It is hoped that it will be possible to report improved motion at a future time.

RESULT OF EXCISION OF WRIST FOR TUBERCULOSIS

DR ASHHURST presented a man, twenty-eight years old, who came under his care in August, 1912. When four years of age he had suffered from tuberculosis of the right hip, a cold abscess formed and was opened, but healed soon. He was under treatment for the hip condition until the age of 8 years, being confined to bed 18 months, and on crutches for nearly 3 years. He eventually secured a very useful limb, with fair motion at the hip-joint, but with shortening and adduction, which caused a marked limp. The hip remains weak, and is subject to slight injuries. He walks on his toes.

In February, 1912 he fell and injured his left wrist, and was treated for five or six weeks on a splint for what was considered a fracture of the radius and two of the metacarpal bones. The wrist never became normal, but remained swollen and painful and perfectly useless. In June, 1912 he applied to the Surgical Dispensary of the Episcopal Hospital, and came under the care of Dr Carmany, who recognized the true condition as tuberculous (Fig 8), and dressed the wrist on a palmar splint. In August, when Dr Ashhurst went on duty in the Dispensary, an attempt was made to secure more absolute immobilization by the use of a plaster-of-Paris splint, applied to the dorsum of the forearm and hand, with the wrist in slight hyperextension. Although temporary improvement took place for a few weeks, the disease then began to progress. The joint was hot, red, and painful, the entire carpus was puffed up, on the flexor and extensor surfaces,

gut, there was no tendency for it to be displaced. The external incision at the ankle was closed in two layers, but the inner incision, through scar tissue previously adherent to the bone, permitted of closure only in a single layer of skin sutures. The operation took about one hour. The foot was dressed in plaster of Paris.

The plaster case was removed in two weeks, and the wounds were found healed. Some motion was possible in the ankle-joint. Three weeks after operation passive motion was begun, there was free voluntary motion of about 10 degrees, but the foot did not come up quite to a right angle with the leg. It might have been better to have lengthened the tendo Achillis at the first operation, but this was postponed because of the poor vitality of the tissues in which the arthroplasty was done.

Second operation, October 2, 1913 (eight weeks after the first operation). Dr Ashhurst. The hallux valgus caused extreme deformity (Fig 5), and it was planned to correct this as far as possible, and at the same time to lengthen the tendo Achillis so as to permit flexion of the ankle beyond 90 degrees. The old scar tissue was densely adherent to the projecting head of the metatarsal, but by turning up a flap with its convexity over the proximal phalanx good exposure of the metatarsal joint was secured. The head of the metatarsal was removed, and the toe brought around into proper position. The long extensor of the toe had sloughed away at the time of the original injury, and the only soft tissue which could be utilized to interpose between the sawn surface of the metatarsal and the base of the phalanx was the tendon of the abductor hallucis. This was accordingly turned into the new joint, and the soft parts closed. Then the remaining stump of the third toe was removed, the deforming cicatrix which covered it was excised, and an Agnew operation for webbed fingers was done to restore the contour of the toes as far as possible. The improvement in position is readily seen by comparing the X-rays made before and after operation (Figs 5 and 6). Finally the tendo Achillis was lengthened by the usual Z operation. When the tendo Achillis had been divided it was found that free motion was possible in the ankle-joint flexion to about 70 degrees, and extension to about 120 degrees. The foot was dressed in plaster of Paris at an angle of about 80 degrees with the leg.



Fig. 9

Tuberculous otitis externa, June 7, 1912, duration 1 month



Fig. 8

the fingers were stiff and useless, and though the skin was in good condition and no sinuses were present, it was not considered safe to persist in conservative treatment, especially as the patient had another (healed) tuberculous lesion in the hip, and it was feared this might light up again. A skiagraph made at this time (early in September, 1912) showed involvement of the radius and ulna, all the carpal bones, and the bases of all the metacarpals, except that of the thumb. Unfortunately this plate was broken.

The patient was admitted to Dr Frazier's service in the Episcopal Hospital.

Operation, September 6, 1912. Dr Ashhurst. Ether Esmarch band below elbow. The dorsum of the hand was split between the index and middle fingers, the incision extending on to the radius above the wrist, and being continued through the web of the fingers on to the palmar surface of the hand for about an inch. The extensor tendons were turned aside, the wrist-joint was opened, and the ends of the metacarpals cut off with osteotome, the ends of the radius and ulna were removed in like fashion. Most of the carpus was removed in one mass, but the unciform, the scaphoid and trapezium had to be removed piecemeal. The end of the thumb metacarpal was not cut off, as it appeared to be healthy. The synovial membrane, and the tendon sheaths on the flexor and extensor surfaces were all invaded by the granulomatous tissue, and a rather tedious dissection was required to remove them. The Esmarch band was removed before any sutures were introduced, and there was very little bleeding except from one large branch of the radial which required ligation. The radius was then drilled in two places, and one drill hole was made in each of the metacarpals of the index and middle finger and a suture of aluminum bronze wire was used to approximate the hand to the radius, in the hope of securing firm bony ankylosis and thus arresting the disease. The soft parts were closed with chromic gut sutures; and a small drainage tube was left in the wound. The hand was dressed in almost full pronation, in slight extension, and fixed by anterior and posterior splints of gypsum. The time of the operation was an hour and a half.

Two days later the drainage tube was removed, without disturbing the deep dressings. The first dressing was made ten days

after the operation, when the wound was found healed except at the point where it had been drained

Subsequently a sinus formed on the anterior aspect of the wrist over the radius. This was dressed with mercurial ointment, and the hand was kept at rest in a gypsum splint. The sinus remained moist until the end of January, 1913, more than four months after operation, but during all this time the wrist was painless, and gave no evidence of active disease

A light brace was now ordered, and when seen in March, 1913, the patient was regaining considerable use of his hand, and had fair strength in his fingers, and good thumb motion

Examination, October 20, 1913, over a year since operation (Figs 9, 10, 11). The patient keeps a cigar store, and has no discomfort in the wrist except on violent motion. He can lift and carry almost any weight with the arm extended, the force being applied in the long axis of the hand and forearm, but the hand is weak if force is applied at right angles to its long axis. He goes hunting, and uses his left hand to hold the gun, without difficulty. He can oppose his thumb to the index and middle fingers, but not to the ring and little fingers. His grip is strong. There is rotation in the forearm from a position of almost full pronation to beyond mid-supination (90°). There is slight hypæsthesia in the ulnar distribution to the fourth and fifth fingers. The hand inclines to the radial side, and the head of the ulna is prominent on the dorsum. There is scarcely any motion in the wrist-joint. The wire suture causes no symptoms, but appears to be palpable on the extensor surface of the wrist.

CONGENITAL DEFORMITY OF THE AURICLE AND EXTERNAL AUDITORY MEATUS, WITH LOP EAR.

DR ASHHURST presented a boy, now eleven years old, with a congenital deformity of the left ear. Apart from the disfigurement produced by the lopping over of the pinna (Fig 12) and the existence of supernumerary auricular cartilages on both sides of the head, the external auditory meatus was absent (Fig. 13). Dr T. S. Stewart, skiagrapher to the Episcopal Hospital, who made an X-ray examination, thought the skiagraph showed no evidence of a middle ear. But Dr. C. C. Eves, aurist and

Figs 10 and 11—Result of excision of wrist for tuberculousis—limits of supination and pronation



Fig 11



Fig 10

brought to the Episcopal Hospital, and admitted to the service of Dr G G Davis *There had been no bowel movement since birth*, it was said that the urine once was very dark. The baby's abdomen was immensely distended, very tense, shiny red, and covered with many enlarged veins. The family physician had postponed sending the child to the hospital earlier, because a proctodæum was present. This, however, was found to be only three-quarters of an inch deep, ending in a blind pouch. The condition of the child was critical, the abdomen was so dreadfully tense that it seemed almost unsafe to bend the thighs up upon it for fear it would burst. However, the baby was placed on the operating table (lying on a hot water bag) in the lithotomy position. No anæsthetic was given. A median perineal incision was made 4 cm in length, and deepened through the proctodæum to a depth of about 4 cm from the skin surface. Here the rectal pouch was found, and incised, at once semisolid fæces squirted out in the form of a goose-quill or slate-pencil. The opening was dilated with forceps, and a large quantity of fæces was evacuated. The bowel (the mucosa of which was inflamed and red) was stitched to the skin with interrupted sutures of chromic gut. No ligatures were needed. The time of the operation was fifteen minutes.

The baby's bowels moved almost continuously for 12 hours after operation. No vomiting occurred after operation, the baby nursed well, and next day the abdomen was soft, not distended, and the redness and shininess had disappeared. Four days after operation the baby and its mother were sent home. Three weeks after operation, when the baby was five weeks old, the mother brought it to see Dr Ashhurst at the Dispensary, the bowels acted normally, and the general health was excellent.

Nothing further was heard of the baby until he was brought to see Dr Ashhurst again in September, 1912. He was now four years and a half old, and the complaint was that he had no control of his bowels.

Examination showed the anus and proctodæum as at birth, about half an inch deep, and ending in a blind pouch. Between this and the coccyx was a larger opening, about an inch in length, through which the fæces were passed. The mucocutaneous juncture of this opening appeared normal but evidently there was no sphincter (Figs 15 and 16).

laryngologist to the hospital, who very kindly examined the boy, reported as follows

"Yesterday I examined your patient, Elmer W, and demonstrated that without a doubt there is present a patent Eustachian tube on the left side. The Eustachian catheter was easily introduced into the opening of the tube, and by placing one end of the diagnostic tube into the depression of the auricle on the left side the familiar oscillating sound of the air entering the middle ear could easily be heard when the air was blown through the catheter. The oscillating sounds were so distinctly heard that I feel sure that he must also have an external bony auditory meatus. In testing his hearing on the left side I found that he could hear the higher pitch tuning fork for a short duration. Bone conduction on that side is increased. He also lateralizes for that side when the tuning fork is placed on the vertex.

"These tests indicate that his deafness is of an obstructive type which may easily be due to closure of the external auditory meatus by skin and cartilage."

The patient's birth had been secured by instrumental delivery, and the ptosis of the left eyelid is attributed to injury at this time. The parents also blame this as the cause of the deformity of the pinna, but in view of the other congenital deformities of the ear it seems more rational to consider the lop ear also a congenital deformity.

The boy was admitted to Dr Frazier's service at the Episcopal Hospital, and on August 26, 1913, Dr Ashhurst did the usual operation for lop ear, removing an area of skin from the back of the pinna and from a corresponding surface of the adjoining scalp, and suturing the ear back against the head with interrupted chromic gut sutures. The supernumerary auricular cartilages were also excised from both sides of the head. The result is shown in Fig 14, from a photograph made a month later.

No operation was done at this time on the external auditory meatus, because the parents did not desire it, and it was not urged because Dr Eves had not yet made his examination which demonstrated the probable existence of a middle ear.

IMPERFORATE RECTUM

DR ASHHURST presented a boy, nearly six years of age, who, on January 14, 1908, being then a baby fourteen days old, was

during the months that have elapsed he has been normally free from all intra-abdominal sensations Eats and digests completely a generous general diet Bowels move regularly and spontaneously Has increased in weight Has been transformed from a suffering invalid into a normal active man

CASE XXVII—*Cæcum and appendix and terminal ileum enveloped in a membranous film, ileum angulated, appendix chronically inflamed* (Hospital No 484)

Woman, fifty years of age A stout woman who is still menstruating normally Twenty years ago began to have attacks of pain in the right iliac fossa During the years that have elapsed has had numberless attacks in various degrees of discomfort referred to that region During the last few months has also had discomfort referred to the right hypochondrium At times there is also gastralgia, nausea, and vomiting Constipation is extreme She has had pain referred to the umbilicus Palpation reveals moderate tenderness in both the right iliac and right hypochondriac regions, and deep tenderness at the umbilicus The abdomen was opened through a right pararectus incision Gall-bladder showed evidences of an old cholecystitis without calculi An old and delicate membranous film wrapped together the cæcum, ileum, and appendix, the ileum being bound to the cæcum at a sharp angle by a band of adhesions which invested the appendix The appendix was long, thickened, and congested, and bound to the lower portion of the cæcum It was enucleated and removed The various portions of the pericæcal membranous film were divided No pathological condition under the umbilicus The gall-bladder condition was not active and it was thought not to call for any interference Wound closed without drainage Uncomplicated operative recovery

CONCLUSION

As one reviews these cases, it is quite easy to accept an explanation of the presence of the extraordinary films and bands found in so many cases, investing more or less extensively the large bowel on the right side, the theory that they are persistent remnants of embryonic conditions which become contributors to disease and disability when, by the mechanical irritation of prolapsing organs tugging at a structure which

Operation, September 30, 1912: Dr Ashhurst (service of Dr Frazier, at the Episcopal Hospital) Ether Patient in Sims's position

A grooved director was passed into the anal pouch, and was jabbed through into the rectum above (Fig 15) The septum between the anal pouch and the rectal opening was then slit open,

FIG 15

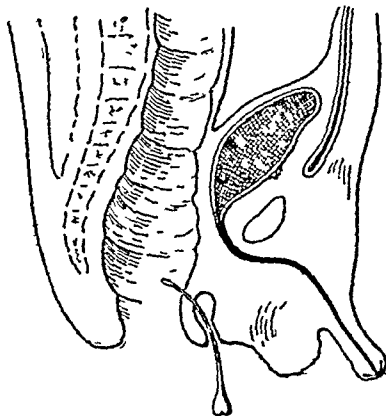
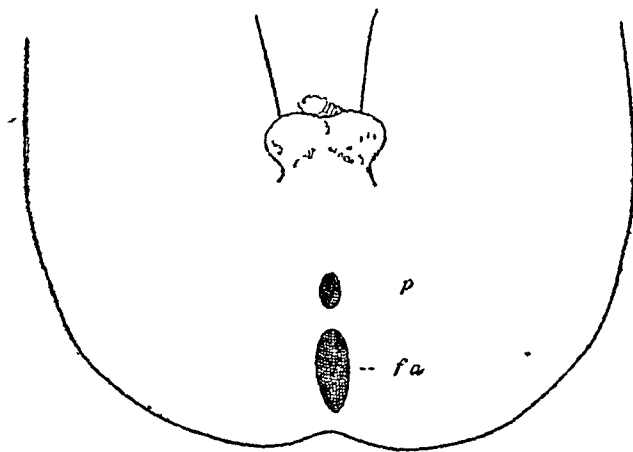


FIG 16



Figs 15 and 16 —Proctoplasty for imperforate rectum, with secondary operation 4 years later to close a false anus in the perineum *p*, proctodæum, *fa*, false anus

on the grooved director as a guide The fold of mucosa which remained on the anterior rectal wall (Fig 17) corresponding to the septum between anus and rectum, was then divided in the long axis of the bowel, and was sutured transversely (Fig 17, 2 and 3), thus restoring the anterior wall of the rectum Then the rectal wall was dissected free from the skin of the perineum

late One morning in April, 1913, on putting his pipe in his mouth (he always held it on the left side) he felt a burning and smarting sensation in his tongue. On his return to the house he looked in the mirror, and saw what appeared to be a slit on the left margin of the tongue, opposite the molar teeth. After one month he consulted his physician, Dr H. M. Freas, who put him on mixed treatment, internally, and used iodine solution locally, over the alveolar border and the floor of the mouth, thinking the trouble arose in the teeth. Nevertheless an ulcer formed and increased in size, it was raised above the level of the surrounding tongue, and its margins and base were hard. Finally, about August, it was noticed that the ulcer was spreading up the anterior pillar of the fauces on the left side. Toward the middle of September, Dr Freas thought some enlargement of the submaxillary lymph-nodes was occurring.

Dr Freas brought his patient to see Dr. Ashhurst on September 20. The growth had then been noticed for about five months. The patient was a large healthy man weighing about 200 pounds. His blood-pressure was 80-160 mm. There were some albumen and casts in his urine, but the quantity of urine was sufficient, and the heart was normal. A "bronchial" cough had been present for the last forty years.

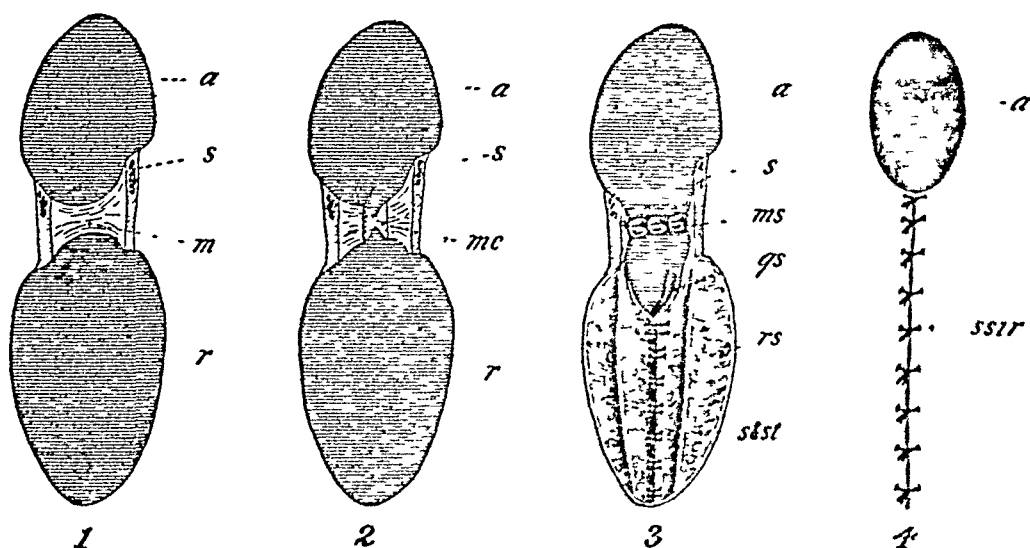
Examination of the mouth showed that the left border of the tongue from one inch back of the tip to the anterior pillar of the fauces was occupied by a raised, hard, ulcerated tumor, with sharply defined borders, and covered by an ashen gray slough. The mucosa covering the floor of the mouth was invaded, but the ulceration did not extend up on to the alveolus. The anterior pillar was just beginning to be invaded. The ulcer did not extend to the midline of the dorsum of the tongue. The tongue was not fixed. The floor of the mouth (mylohyoid) was not involved. Enlarged lymph-nodes were palpable on the left side at the level of the hyoid bone in the submaxillary region, no other lymph-nodes were palpable anywhere, on either side of the neck. A skiagraph showed no invasion of the mandible.

This was evidently a comparatively early case, as such cases go.

The patient was admitted to the Episcopal Hospital on September 23, and operation was done by Dr Ashhurst on September 1913, under anaesthesia by intratracheal insufflation of ether,

all around the false anus and as far back as the coccyx, and was inverted toward the median line of the body in two flaps. These flaps were then united in the median line by numerous interrupted quilt sutures of No. 0 chromic catgut, all the knots being placed on the mucous surface of the rectum. This inverted the mucosa well (Fig. 17, 3). Then the ends of the sphincter ani (divided when the septum was slit open at first) were re-united. Next two buried sutures were employed to approximate the levator ani muscles between anus and coccyx; and finally, the skin between anus and coccyx was closed (Fig. 17, 4). A small tube was

FIG. 17



1, *a*, anus, *s*, sphincter ani, *m*, mucous valve separating proctodæum from rectum, *r*, rectum. 2, *a*, anus, *s*, sphincter ani, *mc*, mucous valve cut, *r*, rectum. 3, *a*, anus, *s*, sphincter ani, *ms*, mucous valve sutured, *qs*, quilt sutures, *rs*, rectum sutured, *s* and *st*, skin and subcutaneous tissues. 4, *a*, anus, *ssir*, skin sutured over inverted rectal wall.

left in the anal opening, to provide for passage of flatus, and if possible to relieve tension on the rectal flaps.

A few of the sutures sloughed out, but good control of the bowel movements was retained, and a finger in the anus detected a strong sphincter. When examined September 20, 1913, one year after operation, the anus was found normal, and perfect control of the bowels had been present ever since leaving the hospital.

EXCISION OF THE ENTIRE TONGUE FOR CARCINOMA

DR. ASHHURST presented a man, aged fifty-nine years, who was an inveterate smoker. Apart from some trouble with his teeth in November, 1912, he had enjoyed excellent health of

from the root of the tongue and anterior pillar of the fauces, from the under surface of the tongue, and from the mass of tissue removed from the neck (submaxillary salivary gland, with submaxillary, submental, subparotid, and upper deep cervical lymph-nodes), fail to show any evidence of metastases. Microscopical sections made from the bone removed from the alveolus also are negative for metastasis."

DR JOHN H JOPSON said that in his experience the after history of cases of imperforate anus is marked not so much by incontinence as by obstruction from the contraction of the opening which is made to replace the imperforate anus. In one case under observation for between five and six years the condition was such that after three or four years operation was contemplated for the relief of the stenotic condition. In this case the anus was absent and the rectum was found high up, there was no proctodæum and the whole dissection had to be carried out through the perineum. Persistent dilatation was maintained up until a short time ago by means of English catheters and later by conical steel bougies. At one time the boy had distention of the colon as a result of stenosis and a plastic operation for its relief was contemplated, but always just as they would decide on this procedure he would improve and get all right, from last accounts he was in splendid health.

A short time ago he saw a child on whom he had operated eighteen months previously, the patient having been lost track of in the interim. At this visit the child was suffering from constipation, and he found here that there was a tendency to contraction of the septum which he had divided above the proctodæum, and he had to order dilatation in this case as well.

DR EDWARD B HODGE mentioned a case seen a few weeks ago, at three and a half years of age, on whom a colostomy had been done two days after birth by Dr Warren Walker. In the paper he referred to Dr Ashhurst brought out the fact that few colostomy patients lived to grow up and have the second operation, but this was a patient who did live and who was fairly well nourished. The child came into the Children's Hospital for the establishment of a rectum. Here also was a proctodæum.

The rectal pouch was easily reached at a depth of $1\frac{1}{2}$ inches, brought down and fastened to the skin with the addition of plastic work to secure a sphincter. So far the result has not been tested, as the colostomy opening has not yet been closed.

DR JOHN H GIBBON said that in his opinion the operation is

administered by Dr W. E Lee and Dr Billings Dr Ashhurst said he would not go into the technic of the operation, as he hoped to bring this subject before the Academy on a future occasion It sufficed to say that the plan of operation was modelled on Cressi and Bastianelli's modification of Langenbeck's method The fat and lymphatics and the submaxillary salivary gland on the left side were removed in one mass, from the bifurcation of the carotid artery to the tongue and mastoid (Fig 18), then the tongue was removed by turning aside the cheek The neck wound was drained by a tube The entire operation took two hours

The patient left the table with a pulse less than 100, and subsequently it never exceeded this rate There was no post-operative vomiting, and at no time any evidence of pulmonary irritation The temperature averaged about 99° F, for the first few days, and then reached normal The patient slept well the night after the operation, with a little paraldehyde, which he *said* tasted pleasant to him Next morning he was able to make himself understood in talking He was encouraged to swallow at once, and was able to take liquid nourishment from the first attempt On the third, fourth and fifth days after operation a little liquid food discharged through the neck wound in swallowing, but this did not recur He left his bed on the sixth day, and walked out of the hospital on the twelfth day after operation

Swallowing of solid food was difficult for the first two weeks, but he found that if his mouth was filled absolutely full he could by effort force the mouthful back into the pharynx and so into the œsophagus Before the end of three weeks he had dined with comfort off pork and beans, and took sauer kraut with relish He talks with remarkable distinctness, considering the absence of his tongue, and is fairly well understood by the casual interlocutor, while his family never fail to understand what is said

Pathological Report—The specimens were examined by Dr C Y White, pathologist to the Episcopal Hospital He reports

"The specimen shows a typical epithelioma of the tongue The epitheliomatous tissue extends from the surface one-half to three-quarters of an inch into the meshes of the tongue. This degree of infiltration would indicate metastasis at least to the draining lymphatic glands The lymphatic gland in the region of the sublingual salivary gland is free from metastasis Numerous other microscopical sections,

stayed reduced, but during the trip to the hospital the child developed a cold and died 18 days after operation from pneumonia

He was interested in the theory of intussusception causing the Jackson membranes or Lane's kink adhesions. He had felt that the vast majority of these conditions were acquired and that they must be due to some low grade inflammation of the peritoneum. Just what the most common cause is he had not been able to find out, although he had felt for some time that the appendix was responsible for a great many of them. A localized peritonitis of low grade without perforation of the appendix would seem a plausible explanation. He could understand how an intussusception which has been reduced and which stays reduced may produce a slow forming adhesion, the result of a low grade of localized peritonitis.

DR WALTER ESTELL LEE said that in the sixth case reported he was the operator, and he could corroborate Dr Allen's feeling that many of these intussusceptions relieve themselves. This child was seen by Dr Howard Carpenter three days before operation, with symptoms of acute obstruction, and he advised it being sent to hospital but the parents refused. The next morning the child seemed perfectly well, the bowels moved normally and continued to do so for 48 hours, then the previous symptoms suddenly recurred and the child was brought to the hospital. At the operation the intussusception was very easily overcome, with the slightest traction the bowel was restored, and it was then sutured to the parietal peritoneum.

INJURIES TO THE ACROMION PROCESS

BERNHARD MENCKE (by invitation) presented a paper with the above title for which see page 233

DR T TURNER THOMAS said that if there is one thing about injuries to the shoulder that he would be glad to aid in establishing it is the importance of hyperabduction. It is to the shoulder what the twist of the foot is to the ankle. The great mass of injuries in the ankle region are due in the main to the turning of the foot inward or outward. That is not so obvious in connection with hyperabduction of the shoulder because the limb practically never remains in the position to which it is forced because gravity draws it down again.

If the arm is carried into abduction it is resisted first by the

easier when done from below in cases of imperforate rectum because a dilated rectum is more easily found than after a colostomy has pulled it up and contracted it. He thought, however, it would be a mistake in these cases to try to do a plastic operation in the beginning; what Dr Ashhurst did first, although only producing temporary relief, is the proper procedure.

One case of his own, operated on at the Pennsylvania Hospital later, came into the Jefferson Hospital with a very tight opening through which very little could pass and he found the rectum filled with densely hard enteroliths which bounced on the floor like marbles when removed with a scoop. He did a plastic but had to dilate the opening from time to time; the child now has perfect control.

INTUSSUSCEPTION

DR FRANCIS O ALLEN gave a Review of Twenty-seven Cases of Intussusception at the Children's Hospital. For this paper see page 258.

DR GEORGE G ROSS said that he had seen three cases of intussusception. Two of these were in adults, the other in a young child about 22 months of age. The first adult case was one in which an intussusception occurred during convalescence from typhoid fever, giving rise to symptoms simulating those of perforation. On opening the abdomen an intussusception was found high up in the jejunum. It had occurred only a few hours previously, it was easily reduced, and the abdomen closed, the patient recovered. The second case was a man who had eaten deviled crab which was bad, he was taken violently ill that night; the following morning he had a violent pain in his abdomen and the doctor concluded he had obstruction of the bowel and hurried him to the hospital. He had an enterocolic intussusception which was tightly fixed, the ring about the intussusception was gangrenous, and the condition required an ileocolostomy. In addition to the distention from the obstruction there was a distention from the food poisoning, but the patient died. In the baby the condition came on without apparent exciting cause. He was crawling over the floor when he suddenly grabbed his abdomen and howled with pain. The diagnosis of intussusception had been made by the family doctor in the country. The child's abdomen was opened, an ileocolic intussusception was found, easily reduced and

stayed reduced, but during the trip to the hospital the child developed a cold and died 18 days after operation from pneumonia

He was interested in the theory of intussusception causing the Jackson membranes or Lane's kink adhesions. He had felt that the vast majority of these conditions were acquired and that they must be due to some low grade inflammation of the peritoneum. Just what the most common cause is he had not been able to find out; although he had felt for some time that the appendix was responsible for a great many of them. A localized peritonitis of low grade without perforation of the appendix would seem a plausible explanation. He could understand how an intussusception which has been reduced and which stays reduced may produce a slow forming adhesion, the result of a low grade of localized peritonitis.

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If the arm is carried into abduction it is resisted first by the

capsule, that is the capsule offers the inelastic resistance and gives way first because it is to the skeleton at the shoulder what the bone is to the skeleton between the joints. In adults it is weaker than the bones, in children it is stronger, as shown by the relative frequency of dislocations of the shoulder and fractures of the clavicle in adults and children. When the arm goes into abduction the capsule binds and turns the scapula outward, it reaches a point where it cannot go further and when abduction is carried beyond that point something breaks and it is the capsule in the great majority of cases. When it tears it constitutes a break in the skeleton at the joint which means either a sprain or a dislocation, the sprain being a tear or break in the skeleton at the joint without displacement, and dislocation with displacement. In most cases the capsule tears. It is after the capsule tears that this contact takes place, that is the leverage and fulcrum effect from the contact of the humerus with the acromion, and it is right there occurs the crucial movement in these injuries to the shoulder region.

Hyperabduction is responsible not only for dislocations of the shoulder, but perhaps also for other conditions such as fracture of the surgical neck or a break in the lever at the fulcrum, fracture of the acromion, or a break in the fulcrum, and the upward dislocation of the outer end of the clavicle, the articulating surface of which favors the forcing inward, by the lever, of the acromion under the clavicle. Nothing is more difficult to prove than the actual mechanism of injuries to the skeleton.

MODERN LABORATORY METHODS IN THE DIAGNOSIS OF SURGICAL DISEASES OF THE GENITO-URINARY TRACT

DR. A. T. GAILLARD (by invitation) presented a paper dealing with the above title for which see page 267.

DR. B. A. THOMAS said that he was not as enthusiastic as Dr. Gaillard over the value of the microscope in diagnosis of diseases of the genito-urinary tract, although giving it due credit for its great worth. Other procedures can aid in the diagnosis, and many of them are of more value than is the microscope alone. Dr. Gaillard said the radiogram left in doubt about 75 per cent of diagnoses of calculus of the kidney, and that 50 to 75 per cent are due to uric acid. It had been his experience that radiography will definitely determine renal or ureteral calculi, if present, in

at least 95 per cent of cases, and we have never yet, with the best radiogram obtainable, found it impossible to make a correct diagnosis of stone in the kidney or ureter. In the case of a very soft urate, assuredly, the skiagram might not show the lesion. In his opinion the skiagram is the measure of greatest value in diagnosis of calculus of the kidney or ureter. Moreover, he could not see that urinalysis alone will diagnose the lesion so far as calculus is concerned, whether of the kidney parenchyma or of the pelvis or ureter when judged from the cytology, it may suffice to locate the inflammatory site, but does not specify that the real lesion is calculus. The cystoscope cannot be superseded by cytological examination in the diagnosis of many of these conditions, particularly in lesions of the bladder, where it is better for the patient to make a definite diagnosis by the cystoscope than to subject him to the lengthy process and uncertainty of repeated urinary examinations. Then again with all due respect to cytology of the urine, it is impossible except by making serial sections of certain tumors of the bladder to tell whether the condition is benign or malignant, because true malignancy may depend upon the disintegration of the base of the tumor, that is, whether or not the basement membrane has been broken through and the underlying tissues infiltrated by the proliferating epithelial degeneration.

capsule, that is the capsule offers the inelastic resistance and gives way first because it is to the skeleton at the shoulder what the bone is to the skeleton between the joints. In adults it is weaker than the bones, in children it is stronger, as shown by the relative frequency of dislocations of the shoulder and fractures of the clavicle in adults and children. When the arm goes into abduction the capsule binds and turns the scapula outward, it reaches a point where it cannot go further and when abduction is carried beyond that point something breaks and it is the capsule in the great majority of cases. When it tears it constitutes a break in the skeleton at the joint which means either a sprain or a dislocation, the sprain being a tear or break in the skeleton at the joint without displacement, and dislocation with displacement. In most cases the capsule tears. It is after the capsule tears that this contact takes place, that is the leverage and fulcrum effect from the contact of the humerus with the acromion, and it is right there occurs the crucial movement in these injuries to the shoulder region.

Hyperabduction is responsible not only for dislocations of the shoulder, but perhaps also for other conditions such as fracture of the surgical neck or a break in the lever at the fulcrum, fracture of the acromion, or a break in the fulcrum, and the upward dislocation of the outer end of the clavicle, the articulating surface of which favors the forcing inward, by the lever, of the acromion under the clavicle. Nothing is more difficult to prove than the actual mechanism of injuries to the skeleton.

MODERN LABORATORY METHODS IN THE DIAGNOSIS OF SURGICAL DISEASES OF THE GENITO-URINARY TRACT

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TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

*Stated meeting, held at the New York Academy of Medicine,
November 12, 1913*

The President, DR. FREDERIC KAMMERER, in the Chair

FRACTURE OF THE SCAPULA

DR. JAMES M. HITZROT presented two young men, each of whom had sustained a fracture of the scapula, one in attempting to stop a runaway horse, the other in a fall from a truck. In the first case, the X-ray showed a fracture through the neck of the scapula. The characteristic deformity usually described in connection with this form of fracture was absent, and there was practically no loss of function. No effort at reduction had been made.

In the second case, the fracture was through the lower facet of the bone, and the lower two-thirds of the articular surface had been carried downward and inward, producing loss of function. The clinical features of this case were fairly characteristic, and there was a marked difference between the two shoulders.

FRACTURE OF THE ODONTOID PROCESS OF THE AXIS.

DR. OTTO G. T. KILIANI presented a man (and the X-ray plate) who was riding to hounds eight weeks ago, when his horse, a heavy English hunter, stepped into a deep, narrow ditch, and in endeavoring to recover itself, threw its head back, striking the rider in the face and breaking his nose. He was stunned, and pitched forward, falling to the ground upon his face. A short period of unconsciousness followed, no vomiting; after two days' rest, he attended to his usual duties. When Dr. Kiliani saw him, about ten days later, the only symptom he complained of was

restrains it, or by an infection transmitted from within the bowel, a mild degree of proliferative inflammation is established that makes more dense and strong the constricting fibres until they interfere with peristalsis, obstruct the fecal current, and aggravate fecal stasis. It would seem as if sufficient clinical observation had now been accumulated to confirm and emphasize the teaching that right-sided pericolic membraniform veils and bands, crippling the peristaltic functions of the cæcum and ascending colon, were of frequent occurrence, and that when present they form a well-defined surgical condition which always is a menace as to the future, and in many cases has already become the cause of ill health and suffering. Whenever, therefore, the abdomen is opened for the relief of conditions involving right-sided symptoms, the operation should be so planned as to make it possible to explore for their presence and do whatever is necessary for their removal.

one could only surmise that it was possibly the result of a sudden, forcible flexion of the head backward, or that the fragment had been torn off by its ligamentous attachments

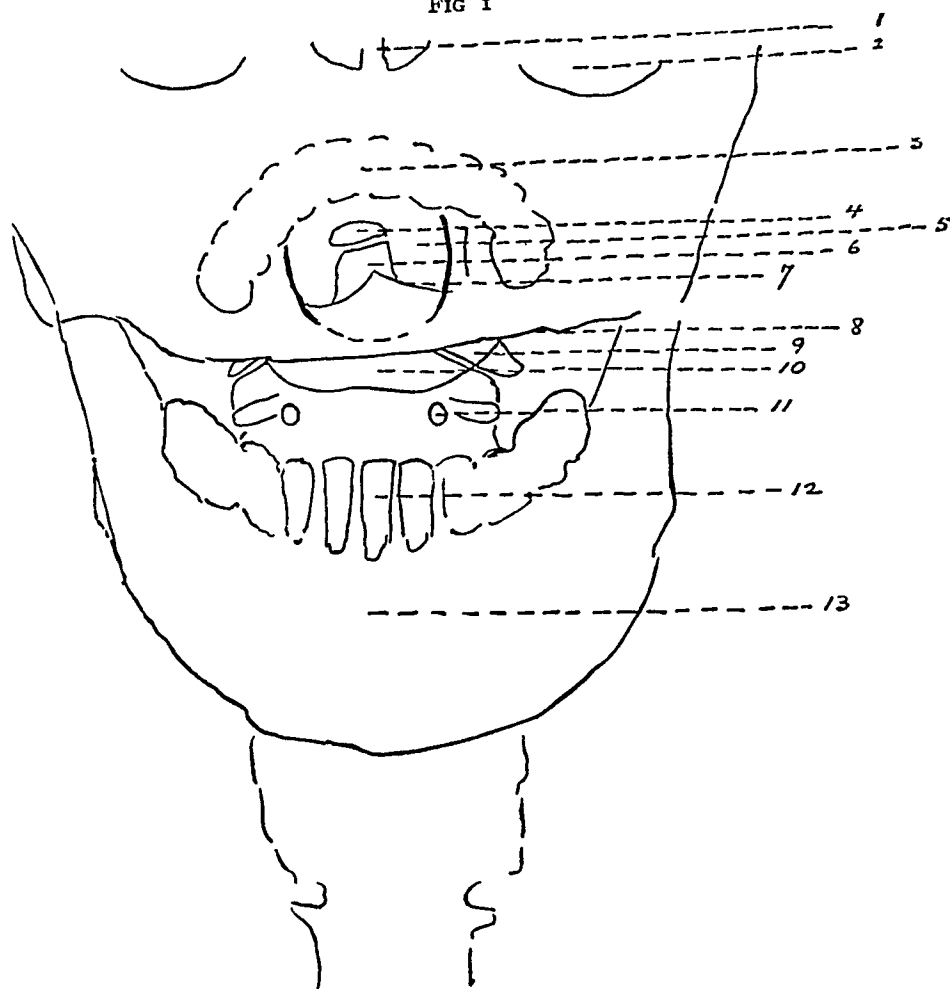
EXPERIMENTAL INTESTINAL OBSTRUCTION

DR JOHN A HARTWELL presented a dog to illustrate the results of some experimental work that had been done by Dr. J. P. Hoguet and himself bearing upon the subject of intestinal obstruction, the object being to find out the direct cause of death in this condition. The dog had been operated upon twelve days previously, when the bowel was sectioned at the lower end of the duodenum and the two ends closed by inversion, thus producing a complete obstruction. The amount of urine and vomitus put out was measured, and the dog received, subcutaneously, normal saline solution in amount slightly in excess of this. During the first four days of the experiment the output was approximately 450 c c per day, which was exactly one-twentieth of the body weight. After the sixth day the vomiting ceased and the stomach tube recovered nothing. The amount of urine, however, increased, and corresponded closely to the amount of saline given. The animal was in perfect condition except for loss of weight, due to lack of food.

Dr Hartwell stated that in this way they had been able to keep dogs in a healthful condition as long as twenty-six days, which was the longest they had continued their observation, but under this treatment no animal in a series of ten had died. On killing these animals, examination of the organs showed a normal liver, kidney and spleen, the only lesion found being a dilatation of the intestine and stomach above the obstruction. Dogs so operated, who did not receive the salt solution, lived never more than ten days, and usually died in five or six. Autopsy in these cases showed a very marked granular degeneration of the kidney and liver, with sometimes actual necrosis of the latter. A comparison of the urine in the treated and untreated dogs showed that of the former to be absolutely normal, while that of the latter contained albumin in excess, two to three times the normal output of nitrogen, and a marked disturbance in the creatin creatinin ratio. These findings demonstrate conclusively a very marked destruction of tissues, which is accounted for by the abstraction of water. Dogs with a low intestinal obstruction behave in exactly

inability to raise his head while lying down No pain on rotation, some pain on flexion to either side, and on flexion backward An X-ray was taken through the open mouth, which clearly revealed a fracture of the odontoid process of the axis, the top of the process being broken off

FIG 1



Tracing of X-ray plate taken by Dr W H Stewart, visiting radiologist of the German Hospital Photograph taken with the mouth open, the patient in a recumbent position, with the occiput on the plate 1 anterior nasal spine, 2, orbit, 3, upper teeth, 4, fragment, 5 foramen magnum, 6 odontoid process, 7, internal occipital crest, 8, lower line of base of skull, 9 transverse process of atlas, 10, anterior arch of atlas, 11, intervertebral foramen, 12, lower teeth, 13, lower jaw

Dr Kiliani said that a rather careful search of the literature showed that this form of fracture had either gone unrecognized, or was extremely rare In most of the cases reported, the fracture was through the neck of the process, lower down than in this case Dislocations of the axis, of course, were comparatively frequent As to the explanation of the fracture in this instance,

mained in bed from two to ten days. He was just recovering from an attack on his admission to the hospital. Examination that time showed slight tenderness and rigidity in the appendix region, nothing else. There was no elevation in temperature. An appendectomy was done, and a slightly inflamed appendix was removed.

Following this operation he was entirely free from symptoms until November, 1909, when he had another very acute attack of abdominal pain which made him fall to the ground. It was accompanied by vomiting and great prostration. He was immediately taken to Bellevue Hospital, where an operation was done for an acute perforation of a pyloric ulcer. The ulcer, which was on the anterior wall, was closed with purse-string suture, and a posterior gastro-enterostomy with short loop by means of the Murphy button was done. His recovery from this operation was completely satisfactory and he remained in good health until May, 1913. He then again began to suffer moderate abdominal pain, this time mostly in the epigastrium, sometimes accompanied by vomiting. The pain usually began in the morning, shortly after breakfast, and continued throughout the day, irrespective of meals, but relieved by vomiting. Blood was noticed in the vomitus only once, and there was no record of his having passed any by stool. After three or four weeks of this condition he came to the hospital and was operated upon by another surgeon. The gastric artery, with the nerves surrounding it, was doubly ligated; the object being to modify the secretion of hydrochloric acid. Some relief was obtained following this operation, but in a few months the symptoms recurred exactly as before. He was readmitted to the hospital early in October, 1913. Examination at that time showed him to be in good condition, well nourished, and suffering only from a recurrence of his previous symptoms. There was a ventral hernia at the site of the previous operations. No points of tenderness were present, and no masses could be felt. A barium X-ray showed that the stomach emptied itself rather promptly and that both the pylorus and the gastro-enterostomy were open. Gastric analysis after a test meal showed a total acidity of 60; combined acidity 48, free HCl 10. No lactose and no blood, many starch granules and undigested food particles. The aspirated material was bright green in color, which was found to be due to the presence of bile pigments.

the same way, with one important difference. In case the over-distention of the bowel above the obstruction becomes so great that the circulation is seriously disturbed, with a resulting damage to the mucosa either in the way of ulceration or necrosis, the dogs cannot be kept alive by the administration of the salt solution.

Dr Hartwell said that further experimentation they had done confirmed this finding, the damage to the mucosa introduced a new factor into the situation, and that when this was present, saline solution would not save life. The experiment, therefore, demonstrated that the cause of death depends upon two factors. First, the loss of water from the tissues, and second, the damage to the intestinal mucosa, from which, apparently, poisons were absorbed, this being the only source of actual poisoning. Though no direct evidence was obtained, microscopical examination of the damaged mucosa indicated that the poison arose from an infectious process in the damaged mucosa.

Dr Hartwell said that a clinical application of these findings had been made in two cases of intestinal obstruction, who had absorbed 7000 c c of salt solution, administered subcutaneously, during the first thirty-six hours following the operation.

Further, it would seem advisable to empty the bowel above the obstructed point when the obstruction had persisted long enough to result in damage to the mucosa, and if the damage was extensive, an enterostomy probably would be of benefit in order to maintain drainage for a few days.

JEJUNAL ULCER FOLLOWING GASTRO-ENTEROSTOMY FOR DUODENAL ULCER

DR HARTWELL presented a man, thirty-three years old, who was admitted to Bellevue Hospital in June, 1907, with the following history. He was a truckman, working very hard, and drinking both beer and whiskey to excess. There was no record of any previous illness. His present illness dated back about one year, during which time he had three attacks of acute abdominal pain in the right lower quadrant of the abdomen. The suddenness and severity of these attacks is witnessed by the fact that he has been seized with them when at work or walking, and has been suddenly incapacitated by the intense cramp-like pain in this region. He has usually vomited at the time of the onset. The pain had lasted severely only for a short time, but he has re-

followed the method of Coffey, in which the soiling of the abdomen is prevented by elevation of the stomach and jejunum by the use of traction sutures

The case is also presented as one more illustration of the fact which we all recognize, namely, that surgical means are at best but an aid toward the cure of gastric and duodenal ulcers. This patient has admittedly been as careless in his diet and in the use of alcohol during the past three years as he was previous to his original trouble. This factor probably has an important bearing on the recurrence of his symptoms.

DR ROBERT T MORRIS said that in one case where he excised a jejunal ulcer there was a recurrence about a year later. The patient died from inanition, and at the autopsy a second ulcer was found about two inches below the primary one. If these ulcers were due to the highly acid character of the stomach contents bathing the newly exposed mucosa, we may fairly assume that its irritating effect is exerted in causing proliferating endarteritis over the areas of distribution of some of the terminal arteries, resulting in a localized anæmia and the formation of ulcer. When this process was under way, it seemed to call out a general or local leucocytosis which acted as a protection against further involvement of the other terminal arteries in the vicinity. The above, at least, Dr Morris said, was a working hypothesis.

ARTERIOVENOUS ANASTOMOSIS FOR THROMBO-ANGIITIS OBLITERANS

DR HOWARD LILIENTHAL presented a man, forty-four years old, married, a Russian by birth, who was admitted to the Mt Sinai Hospital on March 1, 1913, with the history that his illness began eighteen months prior to that time with the appearance of painful red streaks on the legs and knees, the discoloration migrating down to the feet. Eight weeks before his admission, painful swelling of the right foot developed, and three weeks later a physician had incised the right great toe without evacuating any pus and without relief from the pain. The wound failed to heal and had become gangrenous and excruciatingly painful.

On admission, there was no pulsation in either foot, and both feet and legs were mottled in appearance. There was frank gangrene of the right great toe.

After the disease and its prognosis were explained to the

Operation was performed by Dr Hartwell on October 10, 1913, through a median incision in the epigastrium. On opening the peritoneum, rather extensive adhesions were found between the great omentum, the pylorus and the gastro-enterostomy stoma. On freeing these adhesions, the scar of the old ulcer on the pylorus close to the gastric side of the pyloric vein was palpable. The pylorus readily admitted the index finger on invaginating the stomach through it. The stomach itself was moderately dilated. The gastro-enterostomy opening easily admitted two fingers. The jejunum on its anterior surface, immediately distal to the anastomosis, was adherent to the wall of the stomach about one and one-half inches from the line of union. On separating the adhesion, which was comparatively recent, a perforation was found in the jejunum about three-eighths of an inch from the anastomosis. The ulcer, of which the perforation was the centre, was excised, together with the line of anastomosis adjacent to it. The opening into the two viscera thus made was closed by the usual suture method, re-establishing the stoma. Convalescence following this operation was satisfactory, and the patient has been entirely free from any symptoms. His diet, which has been somewhat limited, has been taken without discomfort or nausea.

A gastric analysis, made on November 5, shows a total acidity of 50, combined acidity, 15, free hydrochloric acid, 12. No lactic acid, no blood nor bile.

Dr Hartwell said this case was presented to emphasize several facts. First, that the patient's original symptoms were probably due to the pyloric ulcer, but were relieved by the appendectomy. Unfortunately, no gastric analyses were made at that time. His entire freedom from pain from this time up to the acute perforation two years later is unusual considering the fact that he had previously suffered from attacks of severe pain. The fact that bile was found in considerable quantities in his gastric contents before the last operation is worthy of note, in view of the belief that these marginal ulcers occurring around the gastro-enterostomy stoma are in part caused by the passage of unneutralized hydrochloric acid over a mucosa that normally is not subject to this irritation. The fact that so many of these ulcers occur at or near the stoma makes it seem probable that the operative trauma is an etiological factor. For this reason, the writer has of late discarded the use of the clamps in this operation, and

upon one toe. On admission, he complained of pain principally in the middle toe of the left foot, and there was here a darkening of the skin, with some necrosis of the soft parts. Neither popliteal artery could be felt, and there was no *dorsalis pedis* pulsation in either foot. The middle toe of the left foot showed skin necrosis extending from the nail for a distance of one and a half centimetres upon the plantar surface. This region was extremely tender to the touch and very painful.

On admission, the patient's temperature was 99.2° ; pulse, 92; respirations, 28. His general condition was good. The left foot, in addition to the lesion on the middle toe, was slightly dusky, and there was a trace of œdema upon the dorsum. The Wassermann blood test was negative.

On March 24, 1913, under ether, an incision was made from the highest point over the femoral vessel down to the level of the lower portion of Hunter's canal. The vessels were carefully dissected out, and a temporary ligature was placed upon the vein at a point about one centimetre from its entrance to Hunter's canal. This ligature was merely crossed and held with an artery forceps, and was placed in such a way that it embraced a large tributary, as well as the vein itself. The upper portion of the vein was then permanently ligated and a section made below the ligature, a considerable distance above a large valve. The blood was washed out of the lumen of the vessel with Ringer's solution. The femoral artery was now freed, and a ligature passed around it as far below the section of the vein as possible. Just before this ligature was tightened, however, the forceps holding the femoral vein ligature slipped, and there was a sudden and most annoying hemorrhage. Although the actual loss of blood was not great, the conditions were rendered so unpromising that he was almost induced to abandon the operation and simply ligate the vein. However, the vessel having been secured with the fingers, and the large tributary having been permanently ligated, it was decided to proceed with the operation. A serrafine now took the place of the ligature, the artery was permanently ligated, and while it was controlled from above with two serrafines, section was made just above the ligature. There was considerable slack owing to the extra length of the artery, but thinking that the operation would thus be rendered easier, this slack was not cut away. An arteriovenous anastomosis was now completed by Carrel's method, using No. 13

patient, together with the possible necessity for amputation, he consented to an arteriovenous anastomosis, which Dr Lilienthal performed on March 10, 1913. Through an incision from the groin to the mid-thigh he made the anastomosis in Hunter's canal, employing the method of Carrel, closing off by ligature the continuation of the artery below and of the vein above. In the event of failure it was believed that some circulation might be carried on through the vessels given off above the arterial section.

As soon as the suture was completed and the clamps removed, the vein filled, and a small tributary just below the level of the union spurted arterial blood and had to be ligated. The only change in the foot was the appearance of a patch of pallor about the gangrenous area. The wound was closed with deep catgut sutures and a superficial layer of silk. On the following day the patient's temperature rose to 101° F, but there was no change in the appearance of the foot. On the second day, however, it had a better color than its fellow, but there was no relief of the pain and no venous pulsation had appeared. A month later there was great improvement, all the œdema having subsided and the skin had resumed its natural color.

In spite of a negative Wassermann reaction, salvarsan had been administered, but the pain in the toe was so severe and persistent that it was amputated on April 11. At this operation there was considerable bleeding from spurting vessels, something which the speaker said he had never before observed during an amputation for this condition.

Since the patient's discharge from the hospital, about six months later, there had been gradual but certain improvement. The wound in the foot healed slowly, and even at the present time there was a minute spot where the skin previously healed had been rubbed off. The general appearance of the foot, however, was quite normal, and there was no more pain, which he regarded as one of the most important criteria of the success of the operation.

DR LILIENTHAL presented a second case of arteriovenous anastomosis for thrombo-angitis obliterans, in the person of a man, fifty-four years old, who was admitted to the Mt Sinai Hospital on March 22, 1913, with the story that four months before that date he had applied a solution of carbolic acid to his left foot, and that as a result there had appeared a spot of gangrene.

PERICOLIC MEMBRANES AND LANE'S KINK

WITH REPORT OF NINE CASES.

BY R BLAND WILLIAMS, M D,

OF THE U S NAVY,

[Surgeon, U S Naval Hospital, Brooklyn, N Y

MEMBRANOUS films attached to the colon were long ago described by Virchow and, more recently, by Jonnesco as the "parietocolic fold" and by Treves as the "bloodless fold," but it was not until these structures were described by Lane and Jackson, and their importance as causative agents of serious pathological conditions pointed out, that any particular interest was taken in them. Even now many persons seem loath to admit that an entirely new factor has been injected into the diagnosis and treatment of many, if not a very large percentage of all cases of chronic digestive disturbances.

The structures now commonly known under the names of Jackson's membrane and Lane's kink, differ materially anatomically, and perhaps, etiologically. The former consists of a broad layer of peritoneum or peritoneum-like membrane arising from the posterolateral wall of the abdominal cavity on the right side, emerging above from beneath the liver and at times extending downward to the outer side of the ascending colon as far as the cæcum. From this origin the membrane spreads over the first part of the transverse colon, the hepatic flexure and the ascending colon, and blends with the peritoneum of these structures near the attachment of the mesentery. The extent of the attachments of this membrane is very variable. It is frequently limited to the region of the hepatic flexure.

The membrane causing Lane's kink is a narrow band extending from the peritoneum of the right iliac region to a point on the terminal ileum, usually within a few inches of the ileocæcal valve. This band is attached to the under surface of the mesentery and to the wall of the ileum as far as its anti-

needles and thread six O The anastomosis was rendered somewhat difficult because of the great disparity in size between the small femoral artery and the unusually large femoral vein When the suture was completed and the clamps removed, the vein immediately filled out, and on manipulating the vessel there was a spurt of blood, showing a leak at the line of suture. Two extra sutures were inserted and the clamps were again removed There was now no leakage, but on moving the vein and artery so as to angulate the line of anastomosis, blood again showed This, however, stopped spontaneously, nor could it again be made to flow without the use of undue and dangerous manipulation Feeling a bit uncertain, however, as to the exact condition of the anastomosis, a ligature of chromicized catgut was passed around the femoral vein and another loosely about the femoral artery, and the wound was then closed completely, without drainage, the long ends of the chromicized gut being buried by the cutaneous suture This was done so that in case of accidental hemorrhage, the house surgeon might easily remove the skin sutures and find the ends of the chromicized gut ligatures ready for tightening The necessity for this, fortunately, did not arise

Immediately after the operation the affected foot looked slightly more cyanotic than its fellow Eighteen hours later the color of the foot was excellent, with an apparently good capillary circulation The patient had suffered no shock nor severe pain

Dr Lilienthal said this was the second case of localized gangrene of the foot in which the condition was ascribed to the use of a carbolic acid lotion Personally, he did not believe that the use of the carbolic acid had anything to do with it The speaker said he was naturally interested in the outcome of this operation, as he was the first one to perform it in this way, although he had been anticipated by Hubbard who used another operative method The exact relation of the operation to the cure was very questionable, in his mind He had been informed that in these cases relief would follow simple ligation of the vein, but he preferred to do an arteriovenous anastomosis, in spite of the fact that the results were not very convincing to him, as he had never been able to get any venous pulsation excepting on the operating table Still, the fact that he had been compelled to tie spurting vessels after this operation indicated an arterial circulation, and he

condition of the vessels, and he would not go as high as the thigh unless it was absolutely indicated. He had repeatedly used Dr Moschcowitz's modification of Bier's method and done an osteoplastic amputation, with very good bone nutrition. An operation in these cases should not be looked upon as a cure, but simply as a relief measure. There was no cure for these patients.

As to the matter of ligating the vein, some authority—Coenen, he believed—claimed that relief was obtained in that way by keeping more blood in the affected parts. However, after the production of Bier's hyperæmia in these cases, some of the patients complained bitterly of pain. As to the side-to-side method of anastomosis, which Dr McWilliams preferred, the speaker said he did not approve of it unless we admitted that we were simply accomplishing a ligation of the vein, because he was fairly certain that with this method of anastomosis there was a strong tendency to the production of a saddle thrombosis.

MIXED TUMOR OF THE PAROTID GLAND, WITH MALIGNANT DEGENERATION

The President, DR F KAMMERER, showed a woman of forty-eight years upon whom he had operated for a mixed tumor of the parotid gland, with malignant degeneration, in July, 1913. The patient had noticed a slowly growing tumor below the left ear for the past 3 or 4 years. During the past six months it had increased very rapidly in size, until, at the time of her admission to the hospital, it presented the appearance shown in the accompanying photograph (Fig 2). An elliptical incision was made over the tumor and extended downward to expose the external carotid artery, which was ligated with some difficulty. The extirpation of the growth was accomplished without much hemorrhage. The tumor had entirely eroded the zygomatic arch. The ramus of the lower jaw near the angle had to be removed, with the exception of a small ridge which preserved the continuity of the bone. The buccal cavity was not opened. There was apparently no involvement of any of the lymphatic glands. The facial nerve was naturally divided during the operation. The patient made an uninterrupted recovery, and up to the present time there had been no recurrence. The microscopic diagnosis was carcinoma.

could not recall any case of amputation for gangrene resulting from thrombo-angietis obliterans in which he had found it necessary to ligate a vessel unless the amputation was done very high up—certainly never before during an amputation of the toe, as in the first case shown. Whether the benefit derived by these patients resulted from an obliteration of the vein by thrombosis, or whether there was an actually functioning arteriovenous anastomosis he did not know. He felt assured, however, that both of these patients would have been subjected to an amputation of the foot but for this operation.

DR. C. A. MCWILLIAMS said that at one of the meetings of this Society last spring he showed a patient upon whom he had done an anastomosis between the femoral artery and vein by the Bernheim method, which he thought was preferable to the end-to-end method because there was less liability of subsequent interference with the arterial circulation. In that case, antedating the operation, the patient had suffered from a gangrenous toe, and after some hesitation, Dr. McWilliams said he amputated the toe and the wound healed very nicely, with the exception of a small sinus. The patient was markedly relieved of his pain.

One added advantage of such an anastomosis in this condition, the speaker said was that in case amputation subsequently became imperative it could be done lower down than otherwise.

DR. EDWARD M. FORT said that in his experience with these cases, the pain had varied greatly at different times. In one case in which during a period of eight years he had found it necessary to amputate fragments from all four extremities the pain had been very severe at times, while at other times it was comparatively trifling. As some of these patients are worse in the winter, he had rather held the idea that cold weather was an important factor in the causation of this condition, but recently he had a patient from San Domingo with typical well advanced lesions.

DR. LILIENTHAL, in closing, said he had never seen any satisfactory explanation for this condition. He was not inclined to attribute it to cold weather, nor would that explain why it was practically confined to men, and to young men as a rule. In all of his cases, the patients were addicted to the excessive use of cigarettes.

The speaker said he had seldom found a thigh amputation necessary in these cases. He usually amputated according to the

spinous fossa extending to one finger below the spine of the scapula. There was also marked dulness anteriorly over the left side and the upper part of the left axilla, with bronchial voice and breathing over these areas. There were some subcrepitant râles over the left supraspinous region, with bronchovesicular breathing over the left interscapular region. The breathing sounds were much diminished over the left base, together with impaired resonance. A blood count showed 15,000 white cells, with 54 per cent of polynuclears. The von Pirquet test was negative, and no tubercle bacilli were found in the sputum.

On December 21, 1912, pus was obtained on aspirating in the left axilla, the needle being carried upward and backward. About two weeks later the boy was anæsthetized, and an incision was made from the clavicle downward, dividing the fibres of the pectoralis major, which were then bluntly separated and the second rib exposed. A section of this rib, about three-quarters of an inch long, was removed, and upon aspiration, foul pus was again withdrawn. Upon enlarging this opening with a grooved director and dressing forceps, it was noted that in passing through the abscess cavity the tissues were extremely hard—almost cartilaginous. About three drachms of thick foul pus were evacuated. A tube was then inserted and the wound packed. Prior to this operation, the X-ray had shown a diffuse opacity of the left chest, but nothing like a lung abscess could be made out. At the time of the operation, beneath the thick-walled abscess, apparently normal pleura could be seen moving with respiration. The general pleural cavity, however, was not entered, as the case was apparently one of lung abscess connecting with the bronchus. Dr. Koplik did not agree with this diagnosis, regarding the case as one of apical empyema.

On January 7, 1913, the tube was removed, a strip of tape impregnated with bismuth was packed into the wound, and a stereoscopic X-ray picture taken in the hope of demonstrating the exact location of the lung abscess. Owing to the rather diffuse area of opacity of this entire region of the chest, however, the subsequent picture proved little excepting that the cavity was nearer the posterior than the anterior wall of the chest. The case progressed favorably for about ten days, when the patient again became feverish and complained of considerable pain in the wound. Under nitrous oxide anæsthesia the drainage

The speaker referred to a similar case of carcinomatous degeneration of a mixed tumor of the parotid, not quite as large as the one shown this evening, which he had operated on four years ago. In that case there was no local recurrence, but the patient died 3½ years later of what seemed to have been metastatic deposits in the liver.

In connection with these two cases, Dr. Kammerer had hoped to show a third case of a large parotid tumor, which he had operated on eight years ago, a young woman who was in perfect health at present. In this case, although an operation was done for a second recurrence, the growth showed no malignant degeneration.

In mixed tumors of the parotid or submaxillary gland, which have very gradually increased in size, it was certainly the proper surgical procedure to enucleate them from the investing capsule, leaving the salivary gland intact. For such cases simple enucleation should lead to a permanent cure. The speaker, however, thought that after one or two recurrences it was advisable to do a radical operation, removing the entire gland, even at the cost of the facial nerve, in tumors of the parotid, more especially as statistics seemed to show that the repeated traumatism of operative interference was a decided factor in the conversion of mixed tumors to the malignant type.

ABSCESS OF THE LUNG INCISION AND DRAINAGE. THORACOTOMY

DR. LILIENTHAL presented a boy, thirteen years old, who was admitted to the Childrens' Service of Mt. Sinai Hospital late in December, 1912, where for some time he was under the observation of Dr. Henry Koplik. The history obtained was that he had a left-sided pneumonia in infancy and that his tonsils and adenoids had been removed a year and a half ago. It was said that he had a second attack of pneumonia a few months ago, and following this he suffered from chronic cough and an occasional haemoptoe. About two weeks before his admission his cough became worse, he was feverish, complained of pain in the chest and was easily tired.

A physical examination showed dulness over the left supra-

POST-OPERATIVE INTESTINAL OBSTRUCTION ENTERO-
ENTEROSTOMY

DR EUGENE H. POOL presented a man, twenty-four years old, who was admitted to the New York Hospital on July 8, 1913, with the history that for three weeks prior to his admission he had been confined to bed with an attack of appendicitis. Examination revealed a tender mass, about 2 x 3 inches, in the right lower quadrant. The patient was operated on and an appendiceal abscess was opened and drained. The patient did well until the fourteenth day after the operation, when he complained of pain in the abdomen, with frequent retching and vomiting, and later hiccoughs. He was given a high enema, which was fairly effectual, but his symptoms continued throughout the night and the following day. Upon washing the stomach, which was done three times, a greenish fluid was recovered. Repeated enemata and colon irrigations at first brought away a small amount of gas, finally neither gas nor feces. On the morning of the sixteenth day after operation (48 hours after the onset of the symptoms) the patient was vomiting at frequent intervals small amounts of dark-colored fluid, and was hiccoughing. There was absolute obstipation. While there was no general abdominal distention, visible peristalsis was noted in the upper abdomen.

The abdomen was opened to the right of the midline above the umbilicus, the right upper quadrant and appendical regions presented a mass of firmly adherent intestines. A greatly distended loop of intestine was visible, likewise collapsed loops of small intestine. Three distinct deep-lying bands of adhesions were freed, but in spite of this the bowel remained collapsed, and as it seemed unwise to further prolong the search, a lateral anastomosis with suture was made between the collapsed and distended loops close to the adherent mass. The patient vomited only once after the operation and his immediate recovery was uneventful. Fourteen days after the anastomosis, however, he again complained of pain in the abdomen and vomited a large amount of fluid. The symptoms then temporarily subsided, but five days later they recurred with increasing severity, with every evidence of complete high intestinal obstruction. The abdomen was again opened, this time to the left of the midline above the umbilicus, revealing a condition similar to that found at the preceding operation, excepting that the adhesions were even

opening was stretched so as to permit of digital exploration. Nothing of note was found, and aspiration practised in various directions upward gave negative results. There was still considerable cough and expectoration.

On January 25 the wound in the chest wall had filled up and showed a strong tendency to heal. The cough and expectoration, however, persisted, with occasional rises of temperature. Flatness in the upper, posterior part of the chest extending to the axillary region caused Dr. Koplik to suspect the presence of fluid, probably pus, and under a general anæsthetic the chest wall was again aspirated, the needle being passed through the upper portion of the axilla, pointing upward and backward. Although a large sized needle was used, no pus was obtained at this puncture. At one attempt, pure blood was withdrawn, perhaps a drachm, before the suction was checked. The anterior wound was now explored with the finger, but only the original cavity was found. A needle inserted here and passed through the posterior wall of this cavity withdrew a few drops of extremely thick pus. A dressing forceps following the needle was pushed through until the points were palpable underneath the skin just above the scapula. Here a counter incision was made and a drainage tube of considerable size was drawn through from the back to the front.

Following this operation, the boy's condition gradually improved. The fever and the quantity of the expectoration varied from day to day, but gradually diminished until the drainage tube was removed, the sinus being kept open by a large-sized triple silk ligature. When this was withdrawn, on March 5, the patient still had a pallid, sick appearance, although his nutrition had improved. Upon the withdrawal of the silk, the cavity was injected with iodoform sesame oil and spermaceti (Moseley-Moorhof filling), and for a long time after this was done the patient complained of the taste of the iodoform. The wound was now nearly healed and the general improvement continued, though cough was still present.

The patient left the hospital on April 25, 1913, and was subsequently sent to a convalescent home, where he remained for some time and his health steadily improved. His condition at the present time was excellent.

APPARATUS FOR RECTAL ANÆSTHESIA.

DR EDWARD M FOOTE described this method, which had recently been first successfully employed by Dr James T Gwathmey It consisted, essentially, of the administration, per rectum, of a 60 per cent mixture of ether in mineral oil A cathartic and enema were given the day before operation, while about an hour before operation a hypodermic of morphine was administered Then the mixture of ether and oil, slightly warmed, was injected through a rectal tube by means of a funnel The introduction was made slowly, usually employing about four ounces of ether and two ounces of oil An ounce of ether by measure to thirty pounds of body weight was a safe dose to use The ether was absorbed gradually but rapidly so that the smell of ether could be detected in the breath in about five minutes, and within fifteen minutes the patient fell quietly asleep, without any struggle or muscular excitement The patient was under the impression that he was receiving an ordinary enema, and thus mental shock was eliminated, there was no strain on the heart, no interference with respiration, no coughing nor swelling of the mucous membranes Dr Gwathmey had now employed the method in over 50 cases He employed a mixture composed of 75 parts of ether to 25 of olive oil After the patient was thoroughly under its influence, the excess should be washed out of the bowel It apparently caused no irritation of the rectum nor of the kidneys, and was eliminated largely by the lungs

Dr Foote said that personally he had tried the method in thirteen cases, and so far as his experience with it went, he regarded it as one of the greatest advances in our knowledge of anæsthesia In some cases where the peritoneum, or other sensitive parts had to be handled, he had found it necessary to give a few drops of ether by the ordinary method In about one-half of his cases, there was some nausea, but decidedly less than by the ordinary method of etherization In trifling operations, where prolonged etherization was not necessary, it was not indicated there nitrous oxide was preferable

Dr Pool said he had tried this method of etherization in one case at the French Hospital The operation was a comparatively slight one The details of the anæsthesia were as Dr Foote described, but the patient remained in the same condition for four hours

COMPLETE AVULSION OF THE SCALP

WITH A REPORT OF A CASE.*

BY FREDERICK FLAHERTY, M.D.,

OF SYRACUSE, N. Y.,

Professor of Clinical Surgery in Syracuse University.

COMPLETE scalping of an individual is a sufficiently rare accident to make the report of a case of interest. A few scattering cases have been reported in literature until 1910, when Davis, of Baltimore, in an original memoir reported two unpublished cases, one in the service of Dr. Bloodgood and the other his own, together with a rather exhaustive review of the literature upon this subject, reporting in all 91 cases of complete scalping, 80 of which were due to machinery. In 53 cases due to machinery the line of tearing included one or both eyebrows, in 19 cases it passed above the eyebrow, while in 8 cases it was not reported. Another interesting fact was that 79 of the 80 cases were females and one male, and he was a Chinaman and caught his cue. There was periosteal defect in 29 of the cases. Fifty-seven cases were grafted with complete healing in 33 cases. The mortality was 10 per cent. Of the other 11 cases of complete scalping which Davis reported, 7 were done by Indians and 4 occurred from other causes.

The case which I now report is that of a woman, who on September 9, 1912, while working in a private laundry, caught her hair in a revolving shaft. The scalp was completely torn from the skull from a line below each eyebrow in front, including the upper half of the right ear and the upper portion of the left ear, back to the hair border posteriorly. This made a denuded area 13 inches by 16 inches. There was an area of denuded bone over the left side of the frontal and left parietal bone, which measured about 7 inches in length and 2 inches in width.

I saw her soon after she entered St. Joseph's Hospital. She

* Read before the Syracuse Academy of Medicine, October 7, 1913.

tion, segmentation, and the development of the primary germ layers. The later and more detailed discussion of the development of the organ may be more fitly placed, however, in the chapters dealing with a description of these parts, serving here to make clear the relation and the significance of the various structures. This is especially true in the descriptions of the gastro-intestinal tract, the genito-urinary system, as well as several other organs and tissues.

The publishers have likewise shown a decided interest for the improvement of this volume. The substitution for the harsh and highly colored illustrations of blood-vessels of ones tinted with paler blues and reds and showing some of the general contour of the vessels is much welcomed.

A general criticism that may be justly made of this as well as former editions of the book is the narrow impression of the scope of the subject conveyed through the parts on applied anatomy. The parts deal largely with surgical applications of anatomy. They are useless to the beginning student untrained in clinical branches and still useless on account of their brevity for the student of surgery. Anatomy forms the foundation of all clinical diagnosis and unless it is presented so as to convey to the student its relation to the solution of problems dealing with the life of the individual it remains no longer a science but becomes a mere memory drill.

Aside from this general criticism the reviewing of this book has been a pleasure, since it undoubtedly represents the beginning toward a return of Gray's Anatomy to the high standard it once enjoyed as a text-book of descriptive and applied anatomy.

M T BURROWS

DISEASES OF THE STOMACH. BY GEORGE ROE LOCKWOOD, Professor of Clinical Medicine, Columbia University, Attending Physician, Bellevue Hospital. Octavo, 624 pp. Lea & Febiger, Philadelphia and New York, 1913.

The work is based on the personal observations of the author from material drawn both from private and hospital sources, and represents essentially his individual opinions on diseases of the stomach, his large experience offering him exceptional oppor-

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unsuccessful version. When born the arm was held across the front of the neck, with the elbow highly elevated, the forearm fully pronated, and the palm of the hand looking forward, and being in a position above the opposite shoulder. The limb rebounded to this position when attempts were made to bring it down. The head of the humerus was clearly palpable beneath the spine of the scapula, and in the axilla was a bony prominence, probably the glenoid or coracoid. There was practically complete paralysis. The mother was directed to manipulate the arm daily, and she brought the patient back for observation at frequent intervals at first. The child is now nine months old. Now the head of the humerus stays in the glenoid, and can be felt projecting forward in front of the acromion as is normal; it is not palpable beneath the spine. Great improvement has occurred in the paralysis, and is continuing; only recently there has returned very slight power of extension of the wrist and fingers. Otherwise there is complete paralysis of the musculospiral nerve.

Dr. Ashhurst remarked that it has been maintained by Duval and Quillain (*Arch. Gén. de Méd.*, 1898) that there are no such clinical entities as paralyses due to lesions of the brachial plexus, only two types existing, radicular and terminal, affecting either the spinal motor roots or the nerve trunks below the plexus. It appears to be the contention of Dr. Thomas that nerve lesions of any kind are of extreme rarity, and if not altogether hypothetical at least are secondary in causation and importance to lesions of the shoulder-joint.

The cases he had now cited seemed to him to demonstrate: First, that pure nerve lesions occur (Cases I and II) and may be of much greater importance than any injury to the shoulder-joint even if this is present (Cases III and V); and second, that, as Dr. Thomas has pointed out, posterior subluxation of the humerus is a frequent lesion, often overlooked and perhaps may be the cause of persistence of paralysis (Case IV).

There can be little doubt that surgeons who see many of these cases will have their interest stimulated in the pathogenesis and treatment of the lesions by this further very important contribution made by Dr. Thomas to the surgery of the shoulder-joint.

DR. THOMAS, in closing, said that he did not mean to say that none of these cases of birth palsy were due to rupture of the

mesenteric border Not infrequently, the appendix is adherent to the under surface of the mesentery and from its point of attachment numerous thread-like bands extend to the wall of the ileum In such cases there may be no sign of any inflammation of the appendix, past or present.

Jackson's membrane can usually be divided and separated from the underlying colon practically without bleeding and without leaving an area bare of peritoneum This can sometimes be done with Lane's band, but as a rule, the latter membrane seems incorporated with the peritoneum of the under surface of the mesentery and its division leaves a raw surface which has to be covered in.

The most common effects of these membranes and bands is to produce a kinking or angulation at two points, namely, at the hepatic flexure and in the last few inches of the ileum Such angulation causes a partial obstruction, intestinal stasis, and occasional spasmodic efforts on the part of the intestine to overcome the obstruction.

Three theories have been advanced as to the etiology of the membranes under consideration First, that they are evolutionary in origin; second, that they are congenital or developmental, and third, that they are inflammatory

The first theory is that of Lane and may be briefly stated as follows: In the assumption by man of the erect position, there is a tendency of the intestine to gravitate downward, this tendency being especially marked at the flexures and at the cæcum In the process of evolution, nature forms bands and membranes to support these points—there is a "crystallization of the lines of strain"

The second theory advanced by Mayo, Cheever and others attributes the formation of the membranes to certain abnormalities in the rotation and descent of the cæcum Mayo suggests that the cæcum may insinuate itself beneath a fold of peritoneum and, in carrying this downward, during its descent produces the membrane Cheever believes that the membrane is formed by the cæcum and colon rotating to the left instead of to the right, thus drawing a peritoneal layer over them.

CORRESPONDENCE

THROMBOSIS OF THE MESENTERIC VESSELS.

EDITOR ANNALS OF SURGERY:

Inasmuch as thrombosis of the mesenteric vessels is so infrequently seen, so rarely diagnosed preceding exploratory laparotomy and post-mortem examination, and knowing that the mortality in this disease is so extremely high, 92 per cent to 94 per cent (Jackson), I thought it would be of interest to some one to report a case which was referred to me for operation May 6, 1913, by Dr D. C. Perkins of Jamestown, N. Y.

Patient, Mrs. D., German, housewife, family history negative, mother of eight living children, the youngest five years of age. Patient had always been well up to about January 1, 1913, when she began to have an occasional attack of indigestion associated with vomiting, headache, coated tongue, abdominal pains and unusual constipation. Menstruation regular, piles, and occasionally noticed blood in stools. The above condition persisted, attacks re-occurring about every two weeks, until she entered The Jones General Hospital, Jamestown, N. Y., April 21, 1913, nearly four months after her first attack.

Patient's examination on entering hospital revealed a fairly well nourished woman, but who stated she had lost about fifteen pounds in weight in the previous three months. Physical examination negative, except coated tongue, slight tenderness over the whole abdomen and a few internal hemorrhoids. Temperature 99.5°, pulse 100, respiration 22, urine alkaline, specific gravity 1.018, no sugar, no albumin, complained of some abdominal cramps and did not care for diet.

is deserving of close study at this time particularly, when we are gradually entering into phases and treatment of diseases evolved from the physiology of internal secretions and fundamentally based on the pathology of the living rather than the dead

JAMES T PILCHER

CARBON DIOXIDE SNOW Its Therapeutic Uses By J HALL-EDWARDS Birmingham, London Simpkin, Marshall, Hamilton, Kent & Co, Ltd 1913

In this little volume the author sets forth the methods of collecting, preparing, transporting, and applying carbon dioxide snow in a clear and readable manner In addition to giving the ordinary means of collecting the snow, the writer describes the use of special apparatus which he has designed for the purpose The manner of application, effects, length of exposure, and amount of pressure necessary are gone into very thoroughly, and while reference to cases treated has been purposely omitted, a list of diseases in which the snow may be successfully used is given, and the treatment of those conditions in which snow has been most extensively employed is described in detail The printing is excellent, there are numerous illustrations, and the book may be commended as a reliable guide to those desirous of trying this form of treatment

JOHN A C MACEWEN

brachial plexus but he believed that none of his twelve cases were. He thought it fair to say that most cases are not. There was no doubt in his mind about rupture of the nerves in Boyer's case.

With regard to anterior luxations at birth, he had not seen them. The only autopsy report of a congenital anterior luxation of the shoulder-joint which Stimson could find is one reported in Stimson's book, observed in 1847 by Smith, which was a double anterior dislocation. Stimson concluded that Smith did not have a congenital dislocation in this case, and after reading Smith's report he would agree with Stimson.

CANCER AND PRECANCEROUS CONDITIONS.

DR. WILLIAM L. RODMAN read the Annual Oration for 1913 on the above subject, for which see page 47.

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227-231 South Sixth Street,
Philadelphia.

Under ether anæsthesia by Dr William M Bemus, and assisted by Dr Perkins, by median line incision, the abdomen was opened, in which there was about one pint of brownish fluid and about six feet of gangrenous small intestine extending from a point about four inches from the ileocæcal valve. The mesentery was markedly thickened and œdematous and in it could be seen and felt the thrombosed veins and arteries, all other abdominal organs normal except slight congestion. The fluid was sponged out and 72 inches of ileum resected; the incision at both ends of the diseased intestine being made through the healthy bowel about three or four inches from the line of demarcation. As much as possible of the diseased mesentery, containing the thrombosed vessels, was removed with the diseased bowel. Both ends of the normal bowel were closed and a lateral anastomosis made between lower part of remaining ileum and cæcum.

Punctured cul-de-sac and inserted rubber drainage tube into vagina. The intestines were gently cleansed with salt solution and the abdominal incision closed without drainage.

Patient received subcutaneous salt solution during the following 48 hours, followed by nutritive enemata for five days when they were substituted with beef juice by mouth.

During the three days following operation there was profuse discharge of brownish fluid through cul-de-sac drainage tube. The abdominal wound healed promptly, patient made an uneventful recovery and was discharged from the hospital well, four weeks after her operation. At the present writing, which is six months since her operation, patient is well and is able to do the household work for her family of seven.

Much effort has been made, without success, by Dr Perkins and myself to discover the etiological factor in this particular case.

Jamestown, N Y

F H NICHOLS, M D

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No. 2

ORIGINAL MEMOIRS

THE PRESENT STATUS OF BISMUTH PASTE TREATMENT OF SUPPURATIVE SINUSES AND EMPYEMA.*

BY EMIL G. BECK, M.D.,
OF CHICAGO, ILL.

Surgeon to the North Chicago Hospital.

NEARLY eight years have now elapsed since I began to employ the bismuth in diagnosis and treatment in sinuses, etc. During this period a variety of cases amounting now to over 1100 cases have been treated by myself and my brothers, which naturally have given us ample opportunity to give the method a fair test. The experience gained from successes and also failures has taught us valuable points, which I shall now bring before you, in order that they may aid you also in correctly applying this method.

Many of you have no doubt had experience of your own in treating abscesses and sinuses with bismuth paste, and are familiar with the method from the literature. This relieves me in a degree of the necessity of discussing the theoretical side of the subject.

In June, 1906, I demonstrated before the Chicago Medical Society this new method, which consists in injecting the sinuses with a mixture of 33 per cent. of bismuth subnitrate and 66 per cent. of vaseline. This mixture must be sterile and liquefied by heating, so that with moderate pressure it

* Read before the International Medical Congress, London, 1913.

disease which produces local deformity of the organ, interference with the complete emptying of the bladder, damage to the genito-urinary tract above and serious ill-health of the patient. The clinical indications of these are designated prostatism.

It is recognized that prostatism may arise from a variety of pathological lesions, the majority producing hypertrophy of the gland. All are of the nature of chronic prostatic disease, and at one period are amenable to direct operative treatment. The latter have been gradually evolved until to-day three main routes of access are employed: (1) the suprapubic—extra-peritoneal transvesical, (2) the perineal, and (3) the trans-urethral, the last being used for the division of the constriction by the cautery or prostatic punch.

ANATOMY OF THE PROSTATE GLAND

The changes met with in the prostate gland in cases of prostatism vary widely and have a morbid anatomy that differs pronouncedly from the normal standard, so much so, that, if the operative treatment of prostatism is carried out solely on an anatomical basis, confusion arises and disaster is liable to follow.

I propose to describe these variations fully, but before doing so, shall refer to certain points in the normal anatomy that are of especial importance and the subject of controversy.

Lobes—The number of lobes assigned to the prostate gland will depend on the method of anatomical description employed, but whether it be subdivided into two lateral lobes or separated into five segments, as I shall do in this paper, it must be borne in mind, that they form a homogeneous entity, and are fused into a single organ, and that in health, they are no more capable of individual enucleation by blind finger dissection, than are the lobes of the female breast. The gland envelopes the prostatic urethra, much the greater part of it being situated behind it, and is traversed by two channels, the urethra and the ejaculatory ducts, and these may be used to subdivide the gland into five segments. On either side of the urethra lie the *lateral lobes*, in front is the *anterior lobe*, the triangular wedge of gland tissue behind the urethra, and above the ejaculatory ducts forms the *middle lobe*, the corresponding portion below the *posterior lobe*.

Investing Membranes—These are two in number, the capsule, and the



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Investing Membranes—These are two in number, the capsule, and the

The third theory, that of inflammation, is advanced by Pilcher, Gerster and others. According to this theory the membrane is the result of irritation caused by the "oft-repeated, but mild," inflammation arising from within the bowel and transmitted through its walls.

Lane, Gray, Fagge and others, in England, and Bainbridge, in this country, describe membranes attached to the splenic flexure and sigmoid in addition to those attached to the hepatic flexure, ascending colon and terminal ileum. The majority of American writers, notably Jackson, Mayo, Pilcher, Binnie and Frazier, describe the membrane as being confined to the right side of the abdomen. The latter view coincides with the theory of the congenital or developmental origin of the membranes, and agrees with the conditions observed in the cases quoted below. In Germany, much importance has been attached to excessive mobility of the cæcum—the "cæcum mobile" of Wilms. American writers seem to agree that this excessive mobility is probably due to the dragging of a dilated and overloaded cæcum, itself the result of an obstruction by membrane at the hepatic flexure. It seems unquestionably true that in many cases the cæcum is unduly movable and prolapsed.

Many writers seem to confuse the condition we have attempted to describe with a general enteroptosis or with ptosis of the stomach and transverse colon, the gastrocoloptosis of Rovsing, the midline ptosis of Coffey. That an enteroptosis will cause attacks of abdominal pain with vomiting and will in time result in a true picture of auto-intoxication, there is no doubt, but in such cases the limitation of the pain and tenderness to the right side of the abdomen is entirely lacking. It is this limitation of pain and tenderness with the other symptoms enumerated below, that makes the diagnosis of obstruction by these right-sided membranes, whether we call them by the name of Lane or of Jackson.

What then are the symptoms that will lead us to a diagnosis of Jackson's membrane or Lane's kink? Briefly, they are symptoms of obstruction and of stasis, the latter evidenced by the symptoms of intestinal auto-intoxication.

Horizontal section of pelvis of male infant at birth to show development of prostatic sheath. Note peritoneal recess between rectum and prostate and relationship of capsule and sheath.

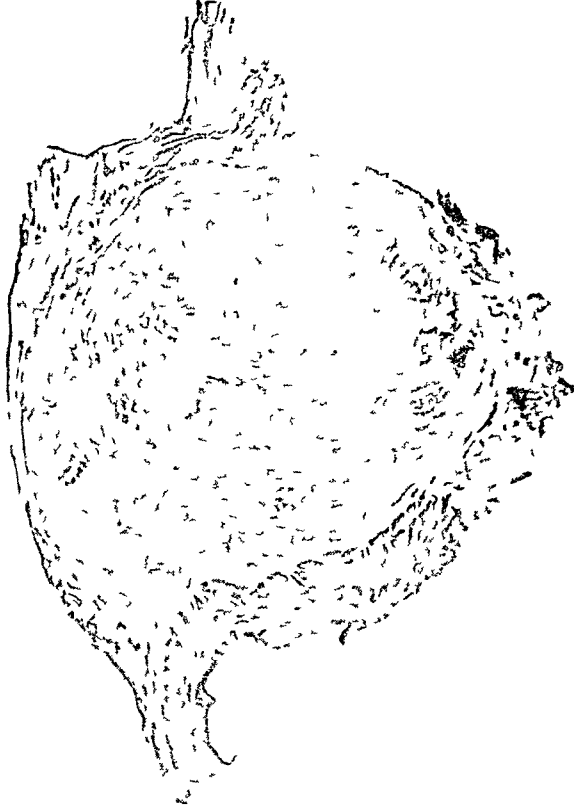


Horizontal section of pelvis of male infant at birth to show development of prostatic sheath. Note peritoneal recess between rectum and prostate and relationship of capsule and sheath.

Fig. 4



Horizontal section of pelvis of male infant at birth to show development of prostatic sheath. Note peritoneal recess between rectum and prostate and relationship of capsule and sheath.



Horizontal section of prostate and rectum of young adult showing the structure and coverings of prostate

FIG 8



Horizontal section of prostate and rectum showing relationship of veins of prostatic plexus to prostate and space of Denonvillier between prostate and rectum



Horizon

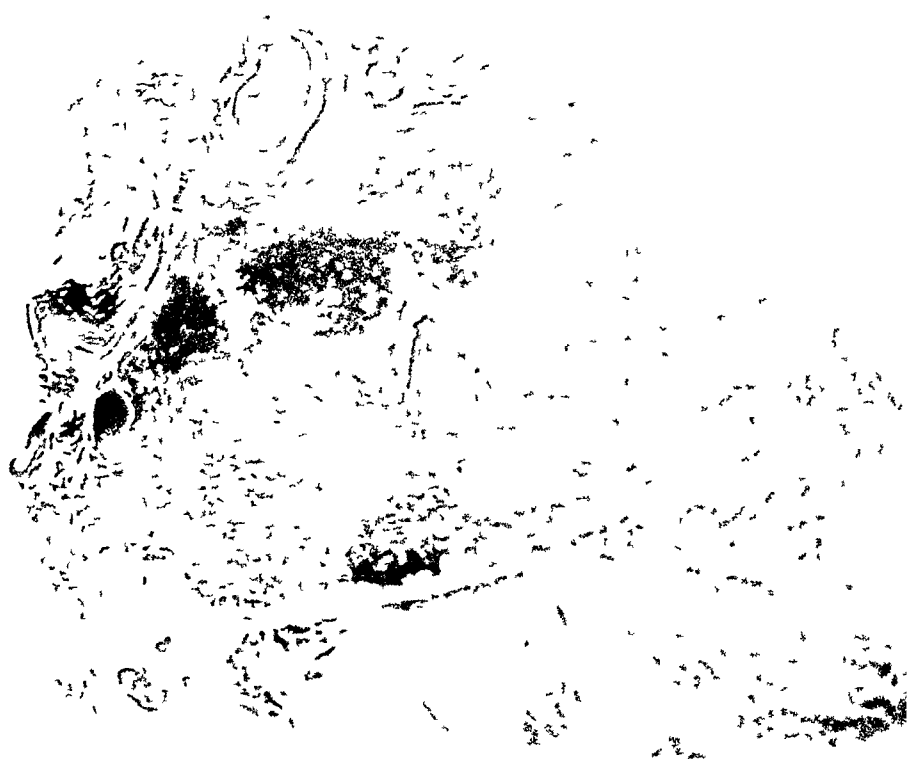
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Coronal section of adult prostate showing (1) formation of internal vesical sphincter from circular muscular coat of bladder (2) external vesical sphincter surrounding apex of prostate and urethra (3) indirect attachment of levator ani muscles at apex and (4) muscular hammock in which the prostate is slung

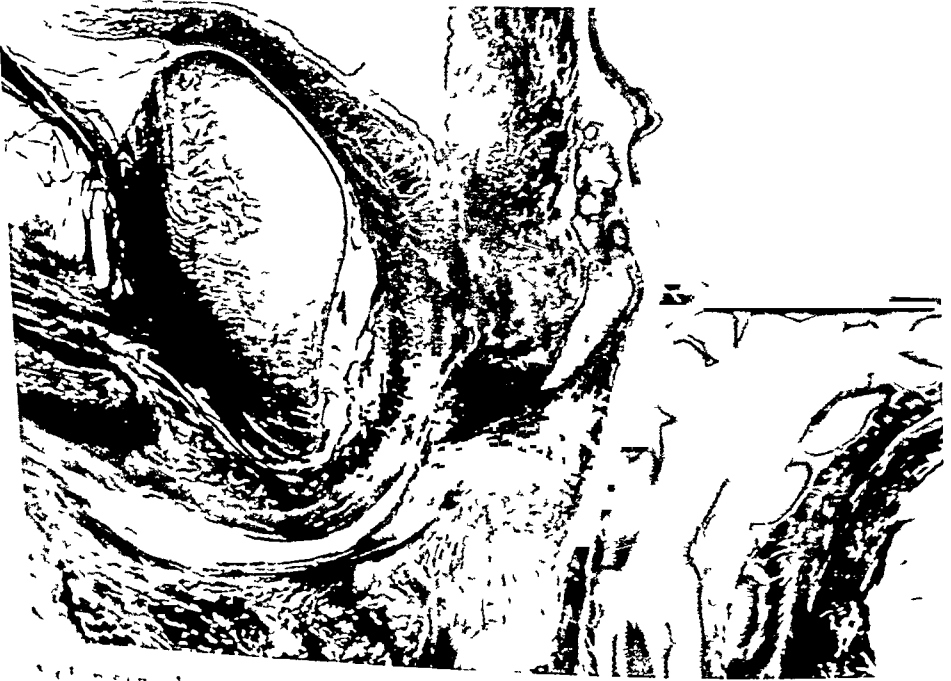


Horizontal section of prostatic carcinoma
(prostatic adenocarcinoma)



Median sagittal section prostate and rectum showing formation of recto-urethralis muscle and situation of Cowper's gland

FIG 14



Sagittal section of pelvis of male infant at birth showing situation structure and relationship of seminal vesicles and ejaculatory duct

Vertical section parallel to the strike of the fault

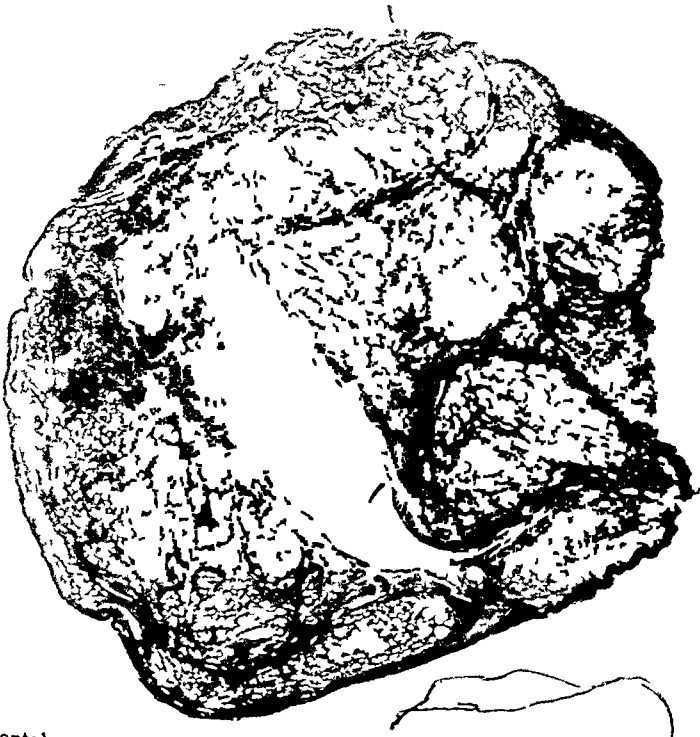
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Horizontal section of prostate and seminal vesicles showing the fascial investment of vesicles and its relationship to prostate and blood-vessels

FIG 18



Horizontal section of prostate removed by the operation of suprapubic prostatectomy for chronic lobular prostatitis (prostatic hypertrophy). The prostate was smaller than normal size, but shows advanced disease.



Horizontal section of prostate and seminal vesicle showing relationship to ureter

FIG. 6

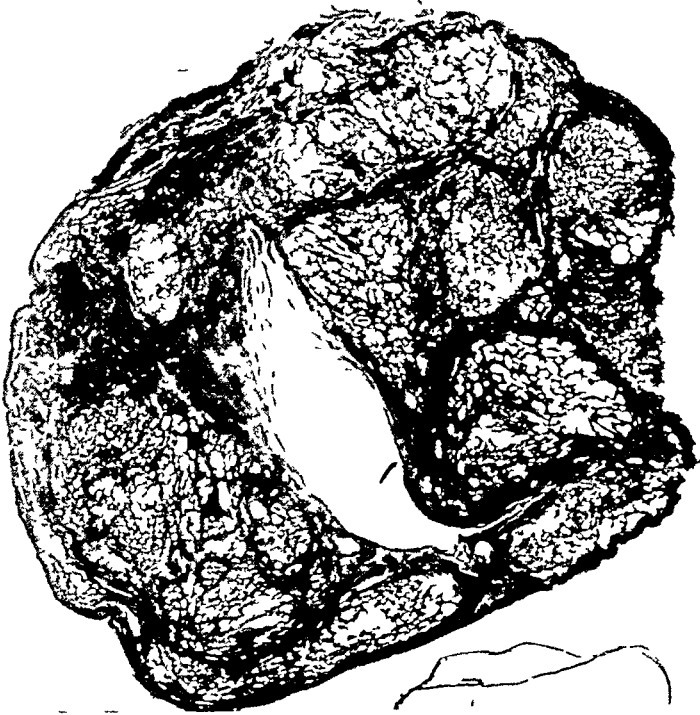


FIG 17



Horizontal section of prostate and seminal vesicles showing the fascial investment of vesicles and its relationship to prostate and blood-vessels

FIG 18



Horizontal section of prostate removed by the operation of suprapubic prostatectomy for chronic lobular prostatitis (prostatic hypertrophy) The prostate was smaller than natural size, but shows advanced disease

is deserving of close study at this time particularly, when we are gradually entering into phases and treatment of diseases evolved from the physiology of internal secretions and fundamentally based on the pathology of the living rather than the dead.

JAMES T. PILCHER.

CARBON DIOXIDE SNOW. Its Therapeutic Uses. By J. HALL-EDWARDS. Birmingham, London: Simpkin, Marshall, Hamilton, Kent & Co., Ltd. 1913.

In this little volume the author sets forth the methods of collecting, preparing, transporting, and applying carbon dioxide snow in a clear and readable manner. In addition to giving the ordinary means of collecting the snow, the writer describes the use of special apparatus which he has designed for the purpose. The manner of application, effects, length of exposure, and amount of pressure necessary are gone into very thoroughly, and while reference to cases treated has been purposely omitted, a list of diseases in which the snow may be successfully used is given, and the treatment of those conditions in which snow has been most extensively employed is described in detail. The printing is excellent; there are numerous illustrations, and the book may be commended as a reliable guide to those desirous of trying this form of treatment.

JOHN A. C. MACEWEN.

When the prostate gland possesses the gross structure and relationships of the normal organ

1 Total subcapsular enucleation by finger dissection is impossible.

2 Extracapsular enucleation by finger dissection is possible but an extremely difficult and dangerous proceeding

3 Total excision necessitates a separation of the capsule from the sheath and as these are intimately incorporated in front the vessels of the prostatic plexus must be wounded

4 To gain access to it from above by the suprapubic transvesical route necessitates division and possible destruction of the internal vesical sphincter, the normal prostate being an extravesical organ

5 The external vesical sphincter will be damaged and possibly destroyed

6. The space of Denonvillier must be opened up and as this is a very loosely obliterated peritoneal pouch, the retroperitoneal cellular tissue planes are in consequence opened as a path along which extravasated blood or an infecting virus may readily extend into the pelvic or extraperitoneal cellular tissue, if the space is not freely drained

7 Conservation of the ejaculatory ducts is impossible in total excision by the transvesical route.

8 The seminal vesicles are likely to be damaged in enucleation and must be dissected free in excision

PATHOLOGY OF PROSTATISM

Incidence of Disease —The frequency with which chronic prostatic disease producing prostatism occurs is difficult to estimate Richardson states that chronic prostatic enlargement has been found in 34 per cent of men over the age of sixty, and of that number 15 per cent suffer from symptoms Plondke has estimated that 33 per cent of all men over 50 years of age suffer from enlarged prostate and that 10 per cent of these require treatment He also says that catheter life results in 100 per cent mortality within an average period of 4 years Personally I am unable to give accurate data not

The symptom most frequently complained of is *pain*. The pain may be acute or it may be chronic with exacerbations, and it is *almost always referred to the right side of the abdomen*. The pain is usually most marked in the region of the appendix (terminal ileum) or at the hepatic flexure. There may be acute attacks of abdominal pain, with or without vomiting, but in such cases the pain is never referred to the epigastrium or diffused over the entire abdomen as is the case with appendicitis. It is in no case a general pain, becoming local, but is commonly referred to some definite locality, in the right side of the abdomen, most commonly the right iliac region.

Less frequently the pain is referred to the region of the hepatic flexure, but in such cases has none of the characteristics of gall-bladder pain with which it might be confused.

In some cases the pain is a chronic soreness with feeling of distention, and in many such cases pressure over the cæcum and ascending colon seems to give relief. In a few cases pain is not localized.

Tenderness is even more strictly localized than the pain. Very commonly this tenderness is most marked at the usual site of appendix tenderness, but perhaps a little lower down. In other cases the maximum tenderness is in the region of the hepatic flexure, that is, below the ribs on the right side but further out than the common site of gall-bladder tenderness.

In many cases there is a feeling of distention by gas. One patient complained of even the weight of his undershirt. These attacks of pain and tenderness are not accompanied by a rise of temperature or an increase in the number of the leucocytes, which further differentiates the condition from an acute inflammation.

Constipation is a marked feature of practically all these cases. It may be moderate or it may be extreme. It may be the chief complaint, or it may not have especially attracted the patient's attention.

Auto-intoxication is a prominent feature of a majority of the cases. In addition to abdominal pain, tenderness, and constipation, these patients complain of backache, headache, lassi-

it seems rational that such should exist, otherwise, the relationship of the testicle and the prostate has been widely investigated. Richardson has shown that the fecundity of an animal is in proportion to the state of development of the accessory genital glands, the most important of which is the prostate. It is also known that when an animal is castrated before the age of puberty, the full development of the prostate gland is prevented, where that gland is removed, however, in later life no essential atrophy of the prostate results. It appears to me likely that prostatic hypertrophy will be found to owe its origin to some alteration in a normal internal secretion.

I do not consider the changes found in the gland in cases of prostatic hypertrophy or, as I have called it, chronic lobular prostatitis to be indicative of a truly neoplastic process.

In chronic lobular mastitis and chronic lobular prostatitis a senile hyperplasia is present. An aberrant overgrowth of tissue occurs that is not the result of the appearance of an independent new growth, although in both cases there is a pronounced liability for the development of the same. They are liable to undergo malignant changes and to develop carcinoma. Although the changes are essentially similar, they are modified by the situation in which the glandular overgrowth has occurred. The prostate gland being firmly encapsulated and possessing a stroma so abundantly provided with muscle fibres, these tend to confine the overgrowth and produce zones of false encapsulation. Where the area of overgrowth in the prostate gland is situated near a free surface, the muscle fibres lead to its partial extrusion, in a manner similar to that in which the uterine fibromyoma is treated, when situated in the wall of the uterus. A similar process is observed in the alimentary canal with gastric and intestinal polypi.

The process known as prostatic hypertrophy, or chronic lobular prostatitis, is virtually always associated with a great increase in the size of the gland, but it is occasionally met with in glands that are even smaller than normal, but clinically have produced pronounced indications of prostatic dysuria (Figs 18 and 19).

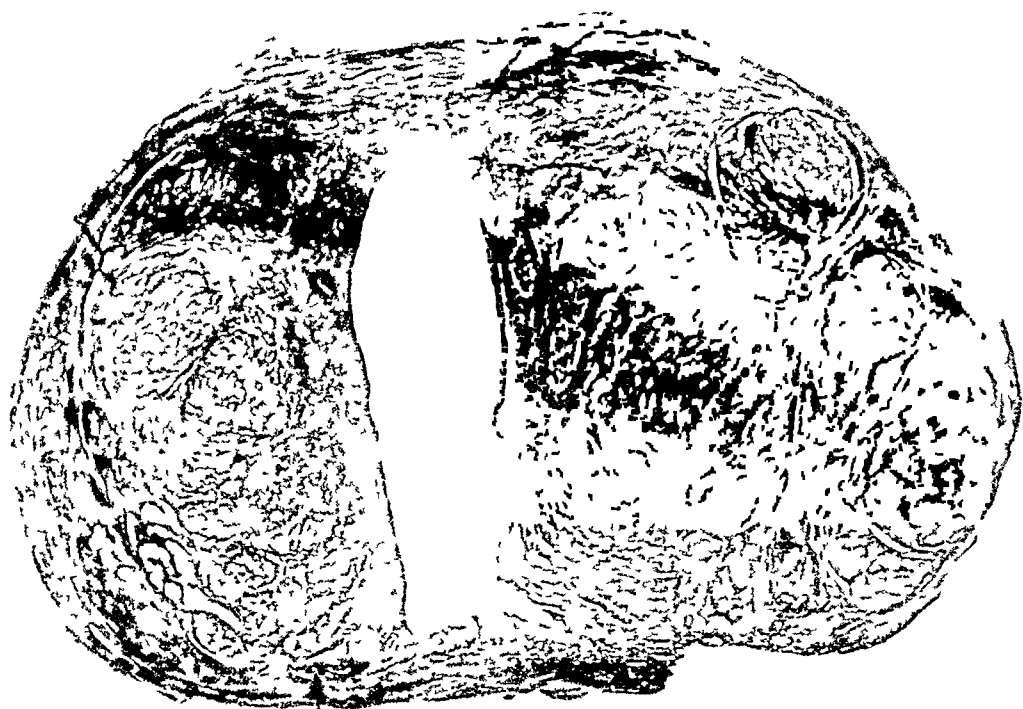
having made enough observations to warrant definite conclusions

Varieties of Chronic Prostatic Disease Producing Prostatism—As I have already mentioned, I have examined specimens from 134 cases of this nature and these have included cases operated on for prostatism, cases dying naturally of the disease without treatment, and fatal cases where operative treatment has been carried out. In all of them the tissue removed was sectioned in celloidin. Paraffin sections were made of smaller portions for more accurate histological examination. Serial celloidin sections were made in most of the cases. They showed three outstanding varieties of disease leading to prostatism—(1) prostatic hypertrophy, or as I would prefer to call it, chronic lobular prostatitis (110 cases), (2) prostatic fibrosis or chronic interstitial prostatitis (10 cases), (3) prostatic carcinoma (14 cases)

Prostatic Hypertrophy of Chronic Lobular Prostatitis—The frequency of incidence of this variety of prostatic disease as the cause of prostatism is such as apparently to lead occasionally to the belief that it is the only cause

The etiology of this disease has been the subject of much dispute. Wilson and McGrath in their recent article enumerate 13 different theories that have been advanced to explain its origin. I do not propose to enumerate these but would suggest that the changes met with in this disease are in their essential nature so closely identical with those observed in another accessory sexual gland, the female breast, when the site of multiple cystic disease or chronic lobular mastitis, that their origin probably resides in factors that are essentially identical. In both cases the gland involved produces an accessory sexual secretion and we know now that the natural stimulus to increase functional activity in the case of the mammary gland comes to it in the form of a hormone, that would appear to be formed in the corpus luteum of the ovary subsequent to impregnation.

I am not aware whether physiologists have worked out a similar relationship between the testicle and the prostate but



Horizontal section prostate removed by the operation of suprapubic prostatectomy for chronic lobular prostatitis (prostatic hypertrophy) Gland smaller than natural size but shows advanced disease

FIG 20



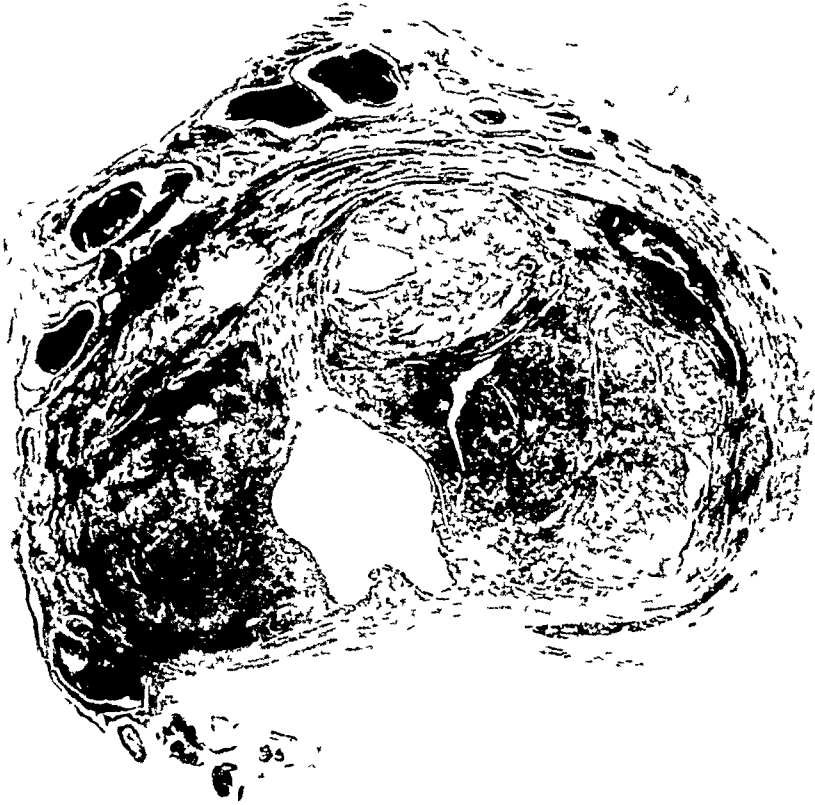
Median sagittal section of prostate and rectum showing prostatic hypertrophy (chronic lobular prostatitis) confined to anterior lobe

Tandler and Zuckerkandl as a result of their investigations made on subjects dying naturally with prostatic hypertrophy claim to have shown that the process is always found involving the middle lobe. In those cases that I have examined, it is undoubtedly by far and away most commonly met with in that situation, but it is also clear that the lateral lobes are frequently involved. In one specimen the disease was confined to the anterior lobe (Fig 20). This later condition is, however, unique.

When the hypertrophic process is confined to the middle lobe, or involves at the same time the lateral lobes, the ejaculatory ducts are displaced downward, and the posterior lobe is compressed and atrophied, and the seminal vesicles are displaced backward (Fig 21). The importance of these changes is that the seminal ducts are carried into a region of safety, and are conserved during the operation of suprapubic transvesical prostatectomy for this disease.

When the prostate gland, the site of chronic lobular prostatitis, is sectioned and examined, it is usual to observe areas of glandular overgrowth in the later stages of which certain of the spaces become distended and show the thin wall and other characteristic appearances of a retention cyst. It is also the rule for corpora amylacea to be scattered throughout the area of disease. The frequency, size, and consistence of these can be well understood, when I state, it was our experience to find that in sectioning the celloidin specimens, it was the rule for the edge of the microtome knife to be broken in one out of every three specimens sectioned, owing to these stony little foreign bodies. The unaffected gland tissue is compressed and condensed along with the interglandular stroma (Fig 22). Toward the surface of the gland, this change results in the formation of a false capsule which consists mainly of muscle strands, and fibrous tissue, but in it there can always be observed compressed and atrophied glandular acini, and these are frequently flattened out, and form a line of natural cleavage that permits of the easy separation of the diseased tissue beneath from the false capsule surrounding it without (Fig 23).

FIG 22



Horizontal section of prostate the site of advanced chronic lobular prostatitis (prostatic hypertrophy) showing nodular hypertrophy in lateral lobes formation of false capsule from uninvolved and condensed prostatic tissue and relationship of blood-vessels in sheath to this

FIG 21



Median sagittal section of bladder prostate and seminal vesicles showing extreme hypertrophy of middle lobe from chronic lobular prostatitis with intravesical herniation and displacement of seminal vesicles and ejaculatory duct and condensation of posterior lobe

FIG 25



Horizontal section of prostate removed by suprapubic prostatectomy "total" enucleation for chronic lobular prostatitis (prostatic hypertrophy) showing one fibromyomatous nodule

Horizontal section of prostate the site of advanced chronic lobular prostatitis (prostatic hypertrophy) showing encapsulation by false capsule of one lobe

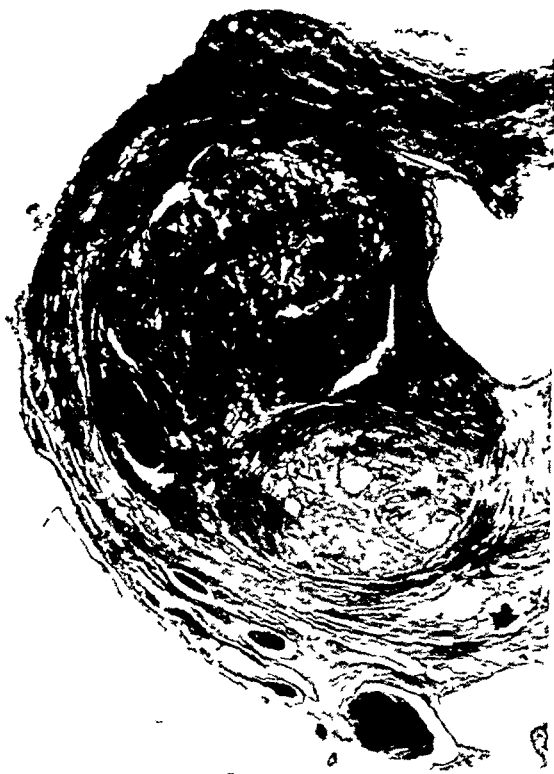
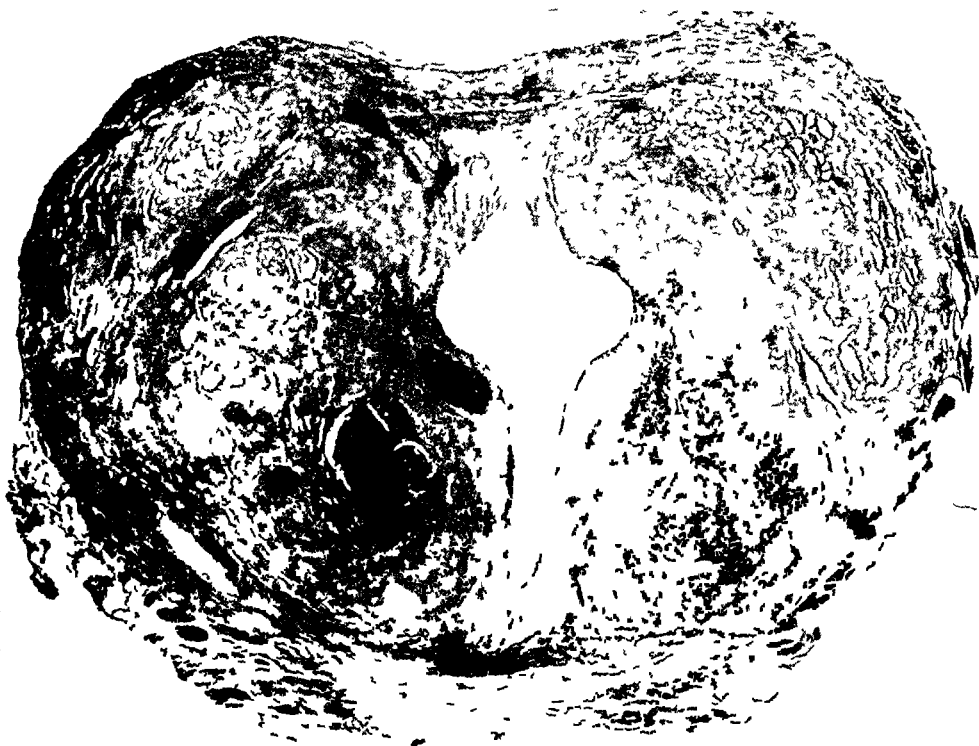


Fig. 24

Horizontal section of prostate the site of advanced chronic lobular prostatitis (prostatic hypertrophy) showing natural line of cleavage formed by flattened gland acini beneath false capsule



hours after taking four ounces of bismuth oxychloride in milk shows marked obstruction at hepatic flexure The radiograph is shown in Fig 1

Operation (March 18, 1913) —Ether anæsthesia Right rectus incision eight inches in length Ascending colon dilated, transverse colon collapsed Just beyond the hepatic flexure a pericolic membrane stretches from the surface of the bowel near the attachment of its mesentery over its anterior and upper surface, losing itself in the peritoneum of the posterior abdominal wall beneath the liver near the attachment of the mesocolon

This membrane is freely divided transversely When division is completed gas is seen to pass into the collapsed transverse colon The constriction is evidently relieved A membrane binding together the last two or three inches of the ascending and the beginning of the transverse colon is likewise divided Appendix removed No Lane's bands or kinks, no obstruction at splenic flexure or sigmoid Abdomen closed in layers

March 27 Recovery uneventful save for signs of moderate consolidation at right base causing rise of temperature to 102.8° on the third day, which almost immediately subsided to normal

April 15 Patient weighs six pounds more than before operation and bowels are moving every day

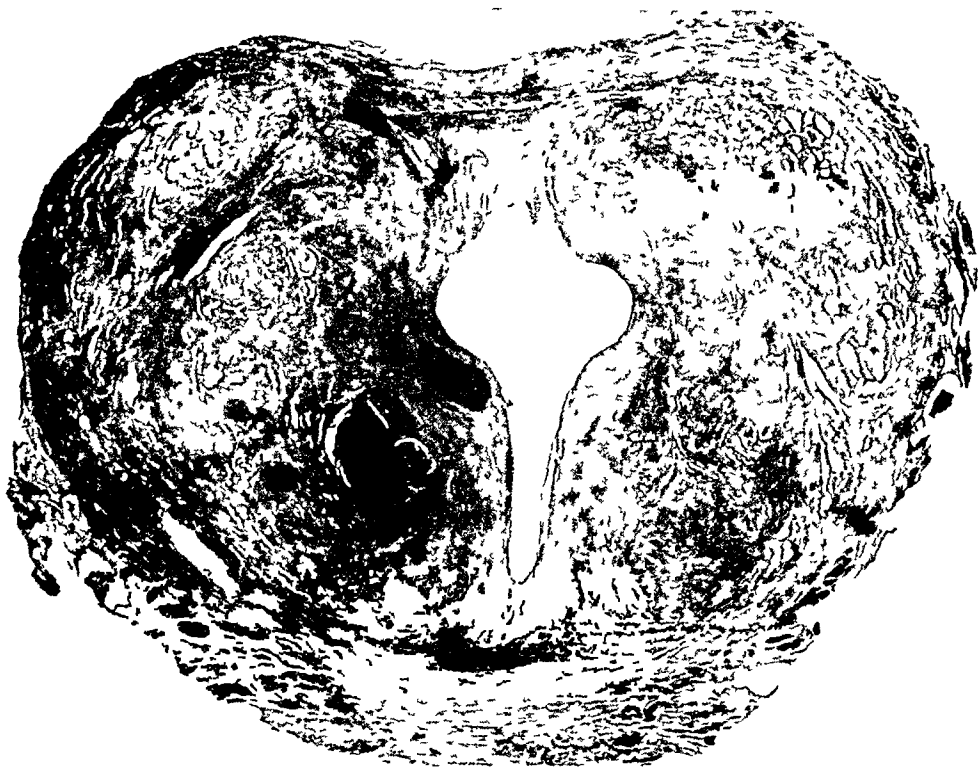
April 28 Discharged to duty, well He feels and looks like a different man

This case has been traced for five months and patient has remained well

CASE II —G A L, chief carpenter, U S Navy, aged thirty-seven years Admitted March 27, 1913, with diagnosis of neurasthenia

Trouble began about eight months before admission with malaise, constipation and vague abdominal pain limited mainly to right side of abdomen The abdominal pain increased in severity and became more strictly localized There were never any acute attacks referred to the epigastric region Constipation became more marked Headache soon appeared with a feeling of fulness in the head, and marked lassitude

With these symptoms he was operated upon three months after the beginning of his trouble (October, 1912) The appendix was removed through a low right rectus incision, and the patient was informed that there was a "Jackson's membrane" He im-



Horizontal section of prostate the site of advanced chronic lobular prostatitis (prostatic hypertrophy) showing natural line of cleavage formed by flattened gland acini beneath false capsule

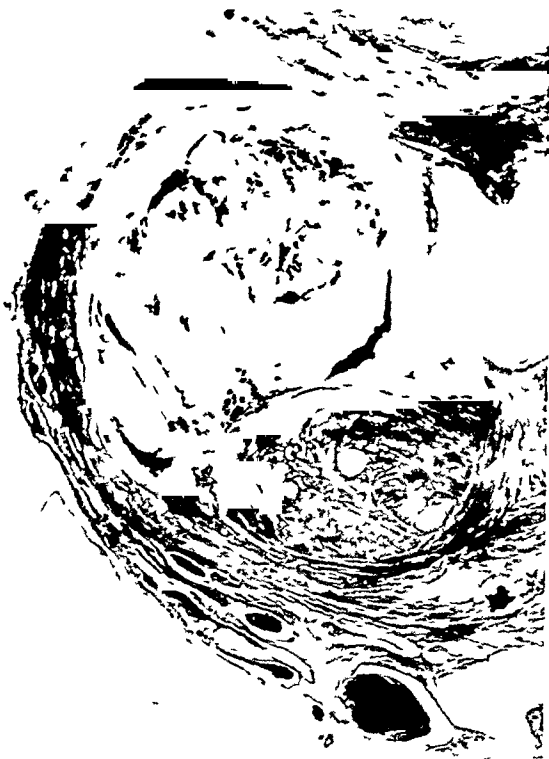
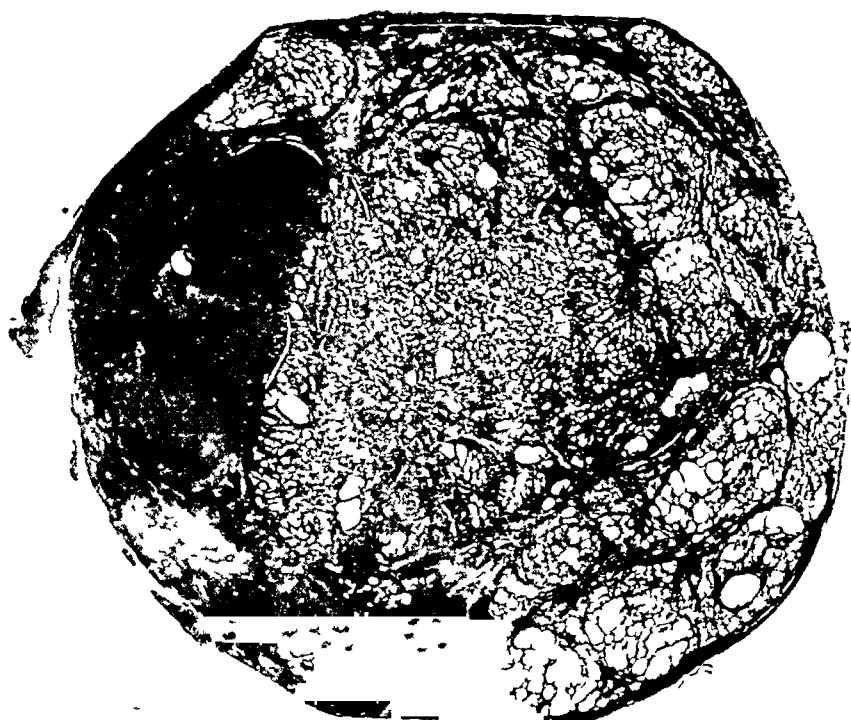


Fig 24

Horizontal section of prostate the site of advanced chronic lobular prostatitis (prostatic hypertrophy) showing encapsulation by false capsule of one lobe

FIG 26



Horizontal section of one lobe removed by suprapubic prostatectomy lobar enucleation
showing fibromyxomatous nodule

FIG 27



Median sagittal section of pelvic contents of man aged seventy-three who died from rupture of urethra with extravasation of urine into space of Retzius, showing hypertrophy of middle lobe of prostate which projects into bladder. Water color drawing of case from which Fig 21 was made.

FIG 28



Median sagittal section of bladder prostate and rectum showing middle lobe forming median prostatic bar in case of chronic interstitial prostatitis

FIG 29



Horizontal section of prostate and rectum from a man aged seventy three who died suffering from prostatism showing diffuse chronic interstitial prostatitis

In a typical case these flattened acini form an arrangement somewhat like the perforations around a postage stamp, the perforations being, however, longer and the bridges much further apart

The arrangement of the spheroids frequently permits of their removal in two masses so that at the operation the hypertrophied gland is described as being removed in two lobes (Fig 24) Very occasionally a spheroidal area of hypertrophy is seen where the stroma is increased very much in amount, and the gland tissue much reduced in quantity, so that a fibromyomatous nodule is produced (Figs 25 and 26) These are, however, not true neoplasms, and of all the cases in which I have observed it, in only one did I fail to detect the presence of atrophied gland tissue amidst the fibrous and muscular tissue, and in this case circumstances did not permit of a complete section of the entire gland These fibroid areas are probably the result of a former inflammatory process When the prostate gland enlarges in chronic lobular prostatitis, in addition to producing for itself a false capsule, it herniates itself through the internal vesical sphincter and comes to lie directly beneath the thin mucous membrane of the bladder floor (Figs 21, 27, and 60)

Prostatic Fibrosis or Chronic Interstitial Prostatitis—Of the 134 cases I have examined, ten suffered from prostatic fibrosis or chronic interstitial prostatitis In this disease the prostate gland is smaller than normal and is of a firm fibrous consistence The interglandular stroma is increased in amount, the whole organ being of a sclerotic nature

It may be considered as having its origin in those various factors that so commonly produce fibrous overgrowth in the interglandular stroma of various organs of the body The circulating toxin that has produced chronic interstitial nephritis may in a like manner produce chronic interstitial prostatitis When the middle lobe of the prostate is especially involved, a fibrous sclerotic bar is produced, which mechanically leads to interference with the voiding of urine from the bladder and a severe degree of retention may result (Fig 28)

It is of importance to realize clearly the morbid anatomy associated with this disease and wherein it differs from that present in chronic lobular prostatitis. In chronic interstitial prostatitis (Fig 29) no false capsule is found surrounding the gland, there being no formation of spheroids in this condition. The natural union between the prostate gland, its capsule, and sheath, is more intimate than normal. There is no intravesical herniation of the gland so that consequently it retains its normal relationship to the internal and external sphincters.

When sections of the gland, the site of chronic prostatitis, are examined the appearance seen is very comparable to those observed in a cirrhotic kidney or liver. The glandular tissue is compressed and atrophied by strands of fibrous tissue amidst which portions of degenerative muscles are situated. Throughout the stroma, areas are present where small cells mainly of the lymphocyte type are accumulated, such as are constantly observed in processes of a similar nature elsewhere.

From the point of view of its morbid anatomy, therefore, the prostate gland in which chronic interstitial prostatitis is present differs in almost every respect from that in which chronic lobular prostatitis has occurred. It is perhaps, its misfortune that the only features it shares in common are the clinical indications of prostatism that are so closely similar as to tempt certain surgeons to treat them by a similar operative technic with occasionally disastrous consequences.

Carcinoma of the Prostate —Of the various neoplasms of the prostate, carcinoma occurs so frequently and other tumors, both innocent and malignant, so rarely as to justify us in confining our attention entirely to the former.

The only true innocent neoplasm of the prostate I have so far personally discovered was an angioma, which was found accidentally in a post-mortem room specimen.

Sarcoma of the prostate is rarely met with. The Museum of Saint Bartholomew Hospital contains a specimen illustrative of this disease and by the courtesy of Dr. Andrews, I am able to show a drawing of it (Fig 30).

According to Young's most recent statistics completed

In a typical case these flattened acini form an arrangement somewhat like the perforations around a postage stamp, the perforations being, however, longer and the bridges much further apart

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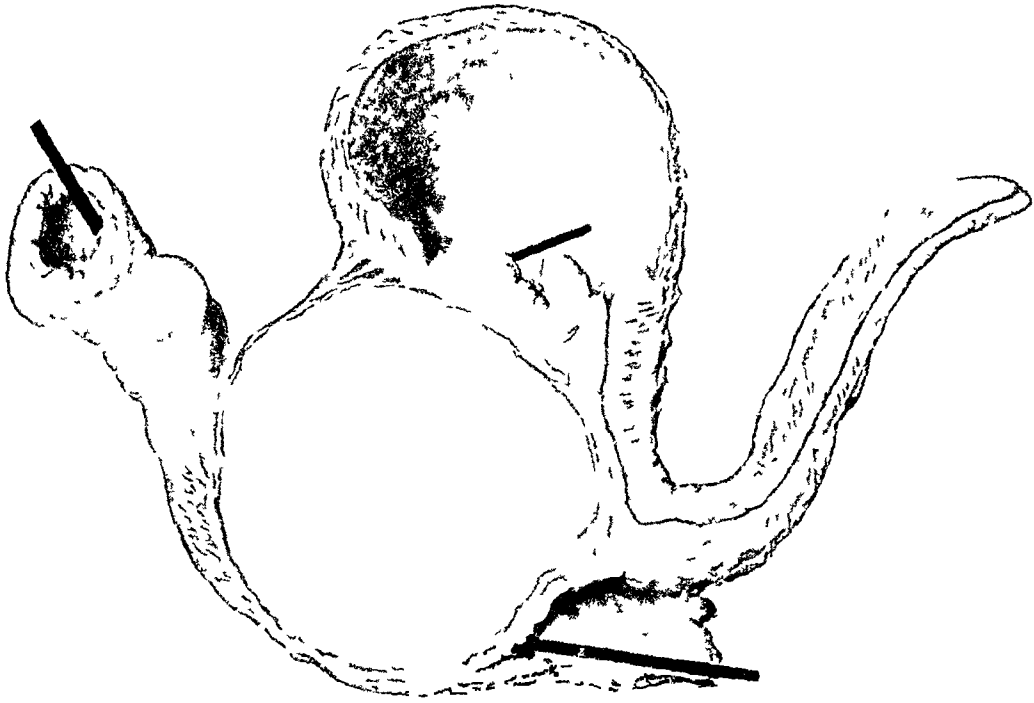


Horizontal section of prostate removed by suprapubic prostatectomy showing carcinoma along with chronic lobular prostatitis (prostatic hypertrophy)

FIG 33



Horizontal section of prostate removed by suprapubic prostatectomy showing scirrhous carcinoma



Median sagittal section of bladder prostate and rectum of a boy with sarcoma of prostate
(From the Museum of St Bartholomew's Hospital by the courtesy of Dr Andrews)

FIG 31



Horizontal section of prostate removed by suprapubic prostatectomy 'total enucleation' showing carcinoma along with chronic lobular prostatitis (prostatic hypertrophy) and portion of prostatic sinus adherent

Section of one lobe of prostate removed by suprapubic prostatectomy showing chronic lobular prostatitis (prostatic hypertrophy). No signs of carcinoma



Fig 35

Sections of portions of carcinoma removed by the operation of suprapubic prostatectomy

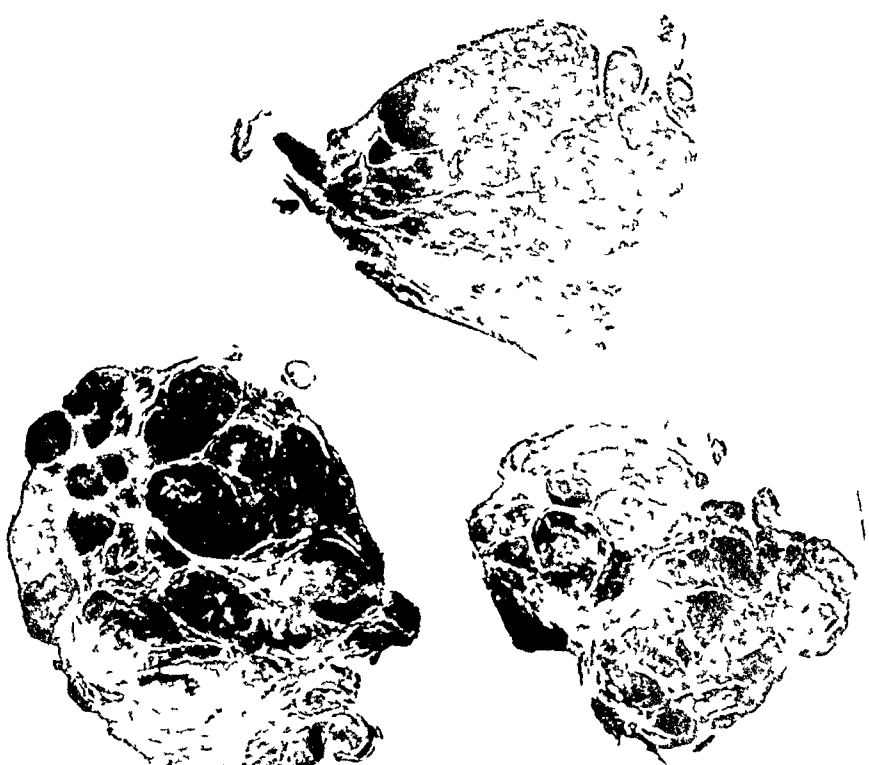


FIG 1



Case 1 Radiograph 12 hours after bisnuth meal showing marked obstruction of the hepatic flexure. At operation a Jackson's membrane is divided which stretched over the flexure and caused the obstruction.

Horizontal section of prostate showing carcinoma infiltrating neighboring tissues implicating the vessels of the prostatic sinus and fixed to rectum



FIG 37

Section of lobe of prostate removed by suprapubic prostatectomy, showing carcinoma along with chronic lobular prostatitis (prostatic hypertrophy) (Figs 35 and 36 were from the same case the tissue being removed in two lobes)

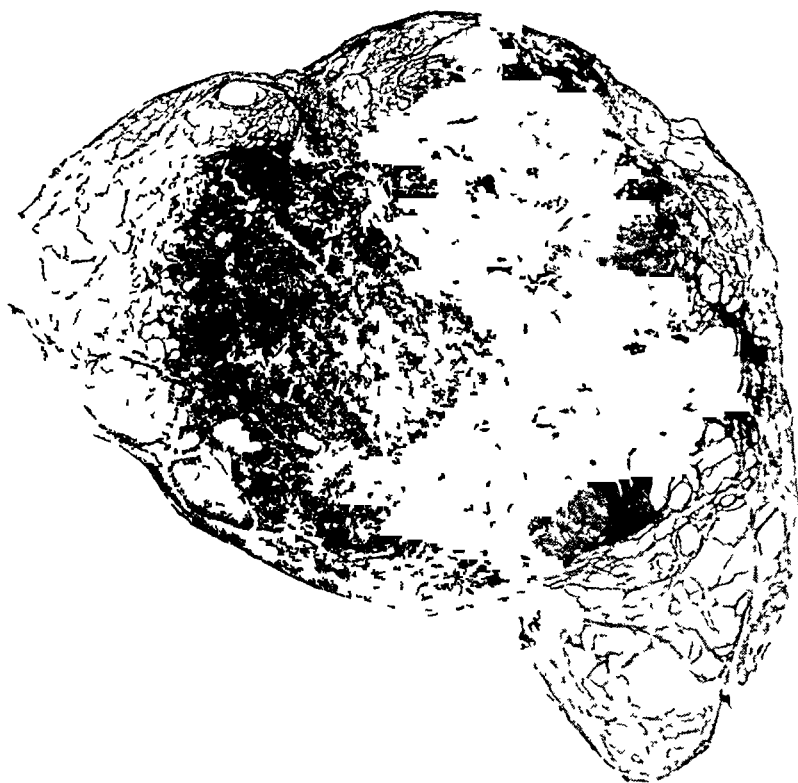


FIG 36

from cases in his own clinic, one case in five of prostatic enlargement causing obstruction in old men is due to cancer. Out of the 134 cases investigated that form the basis of this communication 14 showed carcinoma of the prostate to be present, or approximately one in ten.

The clinical records of fully an equal number of cases of cancer treated by palliative measures, the prostate not being removed, exist, but as no material was available for investigating the morbid anatomy, they are of course not included, but they go to further confirm the accuracy of Young's statement of the frequency of prostatic carcinoma.

In ten of the fourteen cases, prostatectomy was performed and in six of them chronic lobular prostatitis was also present, and had obviously existed antecedent to the onset of cancer, and probably predisposed to its development (Figs 31 and 32).

Three types of carcinoma were found (Figs 33 and 34) (1) Scirrhus, (2) medullary, (3) adenocarcinoma. They were very comparable to the types met with commonly in the female breast and showed a similar degree of malignancy, the last, like the adenocarcinoma of Halsted, being the least malignant. Wilson and McGrath have noted how carcinoma of the prostate is frequently only revealed on careful examination of the specimen after its removal by prostatectomy. In the ten specimens obtained by me from the operating theatre, this proved to be the case. They showed how fortunately at first it is the rule for the malignant disease to commence in the centre of an area of chronic lobular prostatitis, so that at first enucleation is rendered even more easy. Complete celloidin sections being made, they also showed how necessary it is to obtain a complete section for examination before a certain opinion can be expressed on the presence or absence of carcinoma.

In one case this was especially borne out (Figs 35 and 36). The patient underwent prostatectomy, a "lobular" removal being carried out. Clinically, carcinoma was not suspected and the ease with which prostatectomy was accomplished combined with the speedy and uneventful recovery of the patient did not arouse the suspicion that cancer was present. On examining

Horizontal section of prostate removed by suprapubic prostatectomy showing early carcinoma and chronic lobular prostatitis (prostatic hypertrophy)

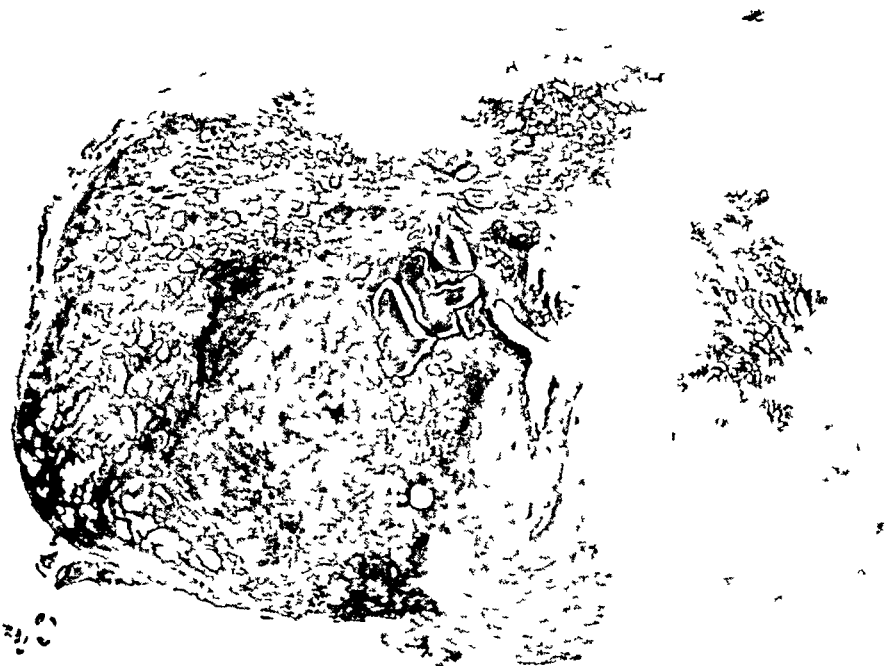


FIG 38

FIG 39



Unilateral acute consecutive suppurative nephritis following prostatism due to chronic interstitial prostatitis. Showing numerous small abscesses in the kidney, hydronephrosis, dilatation of both ureters and recent acute cystitis.

the specimens, however, it was found that one "lobe" was the site of typical chronic lobular prostatitis (Fig 35), while the other showed the same change, but in addition there was present in the centre of it a mass of carcinomatous new growth (Fig 36)

The presence of this was borne out clinically eight months later when the disease recurred and led to the death of the patient from cancer

When carcinoma of the prostate has progressed beyond this early stage of centrally situated disease, one of three results may follow, when the operation of suprapubic prostatectomy by blind dissection is attempted, either the removal is accomplished with difficulty, a "total" prostatectomy being achieved (Figs 31 and 38), or this being impossible, fragments of the diseased gland are extracted with difficulty, danger, and doubtful benefit to the patient (Fig 34), or the disease is found to be so widespread, involving the adjacent blood sinuses and neighboring glands and consequently incapable of even partial removal (Fig 37)

DURATION OF LIFE AND CAUSE OF DEATH IN UNTREATED CASES OF PROSTATISM

Accurate observations on this most important question are difficult to obtain. We wish to know the general frequency of chronic prostatic disease, the duration of life in cases having absolutely no treatment and the causes of death in these. It is also important to possess if possible similar records of the fate of those who have led what is described as a "catheter" life. It has been already mentioned that Plondke has estimated that 33 per cent of all men over fifty years of age suffer from enlarged prostate and that 10 per cent of these require treatment and that, he also says, even catheter life results in a 100 per cent mortality in an average period of four years.

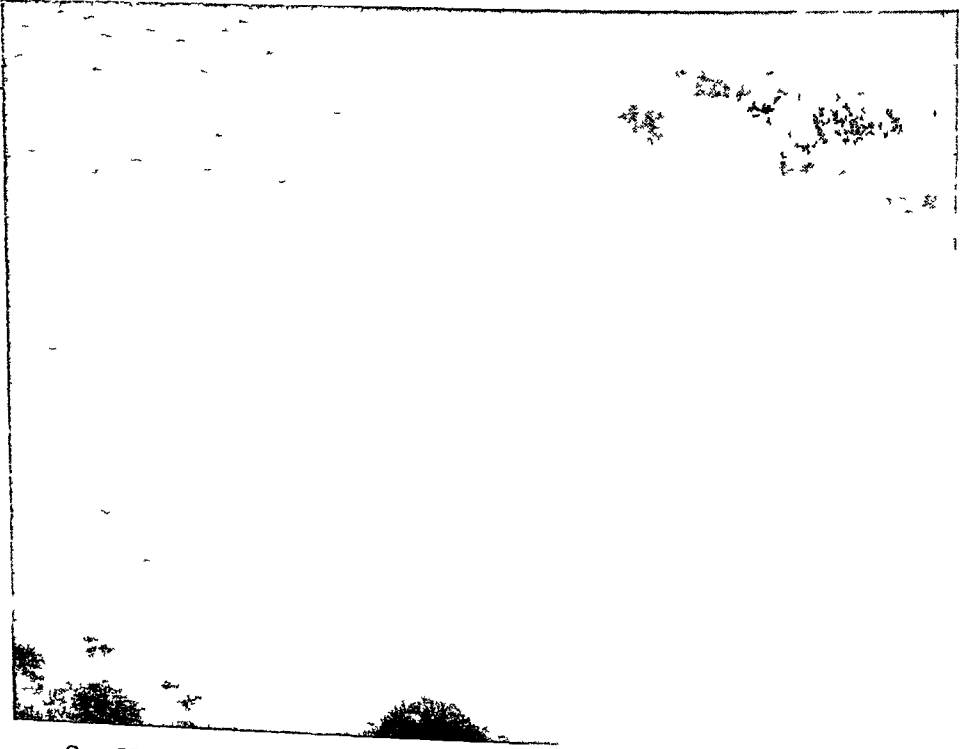
In the absence of the necessary complete data accurate deductions are difficult, but we certainly know that the cases diagnosed early and treated early recover much more frequently than those where the opposite state of affairs holds

good. It is also a fact beyond dispute that pronounced prostatism causes a profound alteration in the genito-urinary tract above. The bladder becomes hypertrophied, dilated, and sacculated. The ureters and renal pelves are similarly dilated and hydronephrosis with pronounced renal atrophy occurs. I have also observed how even in early cases chronic interstitial nephritis is present, and am of the opinion that prostatism may act as a cause of this later change. When interstitial nephritis is present it certainly aggravates it.

In cases dying naturally of prostatism, two forms of death are observed. In one a sudden renal infection brings the patient to a surgeon under whose care he rapidly expires, with or without operative treatment, from acute consecutive suppurative nephritis. In these cases, the organism has usually entered the blood stream from a focus of infection in the lower urinary tract and been determined to the kidney, whose power of resistance to infection has been weakened by prolonged backward pressure. The accompanying illustration (Fig 39) shows this condition. The patient was a laborer, who had suffered for three years from pronounced prostatic dysuria due to chronic interstitial prostatitis. He had received no treatment and when admitted to hospital was in a dying condition. The post-mortem examination revealed chronic interstitial prostatitis with backward pressure, recent acute cystitis and acute unilateral consecutive suppurative nephritis.

On the other hand, a slow renal destruction from persistent backward pressure may bring the patient within the care of the physician. The patient's loss of weight, persistent sickness and failing heart naturally lead to attention being directed mainly to the state of his cardiovascular system. The prostate is probably never mentioned by the patient and is occasionally unsuspected by his medical attendant as the primary cause of his illness and he dies, breaking up in a manner that is characteristic of so many medical ailments. It has been my experience to personally encounter two such cases of this nature. The most typical was that of a man who consulted

FIG 2



Case II Radiograph taken 48 hours after bismuth meal showing acute angulation at the hepatic flexure and marked stasis. Note that the first part of the transverse colon descends parallel with the ascending colon almost to the ileocaecal valve. Note that the tail of the bismuth column has not passed the hepatic flexure at the expiration of 48 hours.

me with reference to the early indications of prostatism from which he suffered. It was a number of years ago, and he was in so excellent health at the time, that I considered it only honorable to dwell at considerable length on the risks of operative treatment for his enlarged prostate. This course I advocated strongly, but he declined and I lost sight of him for two years and a half, when I accidentally discovered him in a medical ward a physical wreck, dying from a failing heart, backward pressure and uræmic poisoning.

Some times such a case comes under a surgeon's care at a stage just prior to the final general breaking up. At this period, the appearance of the patient is sometimes most deceptive. His general health is stated to be good. The amount of urea present in the urine is diminished but to no excessive degree. The ordinary tests of renal functional activity when employed indicate a certain degree of renal insufficiency. Deceived by a fictitious appearance of general good health, the surgeon may operate, as was done in the case from which the accompanying illustration (Fig. 40) was taken and the patient dies, slowly sinking from no obvious and apparent cause or complication, and at the post-mortem examination, the ureters are found to be dilated to a size almost equal to the calibre of the small intestines, and the renal pelves are dilated to such an extent, that the parenchyma is reduced to a thin rim on the surface of two thin-walled multilocular sacs which are all that represent the kidneys.

During the post-mortem examination of patients who have died of various diseases in the medical wards of the hospital, there can frequently be observed, in male subjects over the age of 50 years, indications of a mild degree of chronic prostatic disease with associated damage to the urinary tract above. It is virtually always found that no complaint has been made of this by the patient. It is usually unsuspected, and has virtually never received treatment. In these cases, however, the ureter and renal pelves are dilated to a moderate extent and there is present a recent interstitial nephritis throughout both kidneys, and the renal parenchyma shows

FIG 40



Extreme backward pressure produced by prostatic hypertrophy. Note extreme dilatation of both ureters and renal pelvis and extreme atrophy of renal secreting tissue

being referred to. He reported the result of 25 prostatectomies performed by himself for prostatic hypertrophy 22 were suprapubic and 3 perineal. Three of the former died, a mortality of 13.6 per cent and one of the latter, a mortality of 33.3 per cent.

His contribution to the discussion is of especial interest in that, in discussing the question of mortality, he mentions a point that must be in the minds of most of us, that the mortality of Freyer and Young which was returned at from four to five per cent must not be taken as an indication of the general mortality throughout the world. He says "We must not let ourselves be led into believing that this is the real mortality of the operation as regards the great number of surgeons, you will find a far higher rate of mortality from this operation in the wards of the large hospitals all the world over. In my opinion, this is not due only to deficient technic as compared with that of the specialist, perhaps, least of all so, but far more to the advanced stages of disease of the cases. The true mortality certainly cannot be estimated at less than 10 to 20 per cent."

We have observed when considering the pathology of those cases that died from prostatic disease without receiving treatment, how prostatism if untreated rapidly undermines the patient's health and power of resistance to infection, so that many patients are really in a dying condition when they come under the care of a surgeon.

Page has compiled from the statistical returns of Saint Thomas' Hospital, returns that form a most interesting comparison in this connection. He has collected the cases of prostatic disease that were admitted to hospital and tabulated these according to the variety of treatment they received. The total number of cases treated was 132 and the mortality over all was 21.7 per cent. Those treated by catheterization had a mortality of 22.7 per cent. Those treated by suprapubic drainage, a mortality of 20 per cent and those by suprapubic prostatectomy a mortality of 20.3 per cent.

indications of pressure atrophy through its substance. When the pathology of these cases is viewed by one with a surgical mind, it is impossible to avoid the conclusion that the renal destruction, as a result of the partial retention of urine from the prostatic disease, has contributed to a certain extent to lowering the patient's power of resistance to a general infection, or has poisoned the heart muscle by the retained products of metabolism which should be normally excreted by the healthy kidney.

THE SURGICAL PATHOLOGY OF THE OPERATIVE TREATMENT

The mortality associated with the operation of prostatectomy is high. According to the published statistics of one of the largest hospitals in this country, out of 164 cases operated on during ten years 54 died, a mortality of 35.4 per cent. During the five years from 1906-1910, 69 cases were treated by suprapubic prostatectomy in Saint Thomas' Hospital. Of these, 14 died, a mortality of 20.3 per cent. According to Page, the mortality after the operation of suprapubic prostatectomy for adenomatous enlargement in the four London Hospitals of St. Bartholomew's, University College, Westminster, and Middlesex, during the period from 1906-1910 was 21.5 per cent, 26 cases being operated on, of which 16 died. The mortality of the 1000 cases operated on by Freyer is returned by him at 5.5 per cent. In his first 100 cases, it was 10 per cent, in his last 400, 4.5 per cent. In the last 100 there were only three deaths.

The operation of perineal prostatectomy has been especially practised in America by Young. In the last report of the International Association of Urology, he mentions that he has operated on 450 cases of benign disease by perineal prostatectomy, of these 17 died, a mortality of 3.77 per cent. These results, from the point of view of successful operations, appear to be the best in existence.

In the above-mentioned report, there is also contained the results obtained by a number of other experts and Rovsing's remarks at the above-mentioned congress are well worthy of

THE LOCAL RESULT OF SUPRAPUBIC PROSTATECTOMY

A considerable amount of discussion has centred round the questions, what is removed when suprapubic prostatectomy is performed and what remains of the gland after the operation is completed?

I would propose to show that the change produced in the prostate gland by the operation of suprapubic prostatectomy is determined mainly by the nature of the disease present in it. We will consider first the immediate consequences of Freyer's operation as performed for hypertrophy or chronic lobular prostatitis. When the operation is performed, the tissue removed is found to come away in one of four different methods (1) "Total" enucleation along with the prostatic urethra, (2) "total" enucleation with conservation of the prostatic urethra, (3) lobar enucleation, (4) nodular enucleation.

1 *"Total" Enucleation with Removal of the Prostatic Urethra*—Under this heading are included those cases where the mass of tissue is removed in one piece, and is traversed by the prostatic urethra which has also been removed. When the specimen is examined after removal, it is found usually to have a regular contour and to be coated with muscle fibres arranged concentrically around it. In appearance, it resembles the enlarged prostate gland, but when it is examined, it will be found that fortunately for the patient, "total" removal of the prostate gland has not been accomplished. In order to realize exactly what has been accomplished, the information gained in the operating theatre should be contrasted with the morbid anatomy commonly met with in cases of this disease, that have died without operation and compared with the features seen in complete sections made of the tissue removed and of sections made of the prostatic bed and adjacent viscera in cases that have terminated fatally after the operation.

It is the experience of every surgeon who has performed the operation of suprapubic prostatectomy on several occasions to note the ease with which the large "adenomatous" hypertrophied prostate is frequently removed. The thin mucous

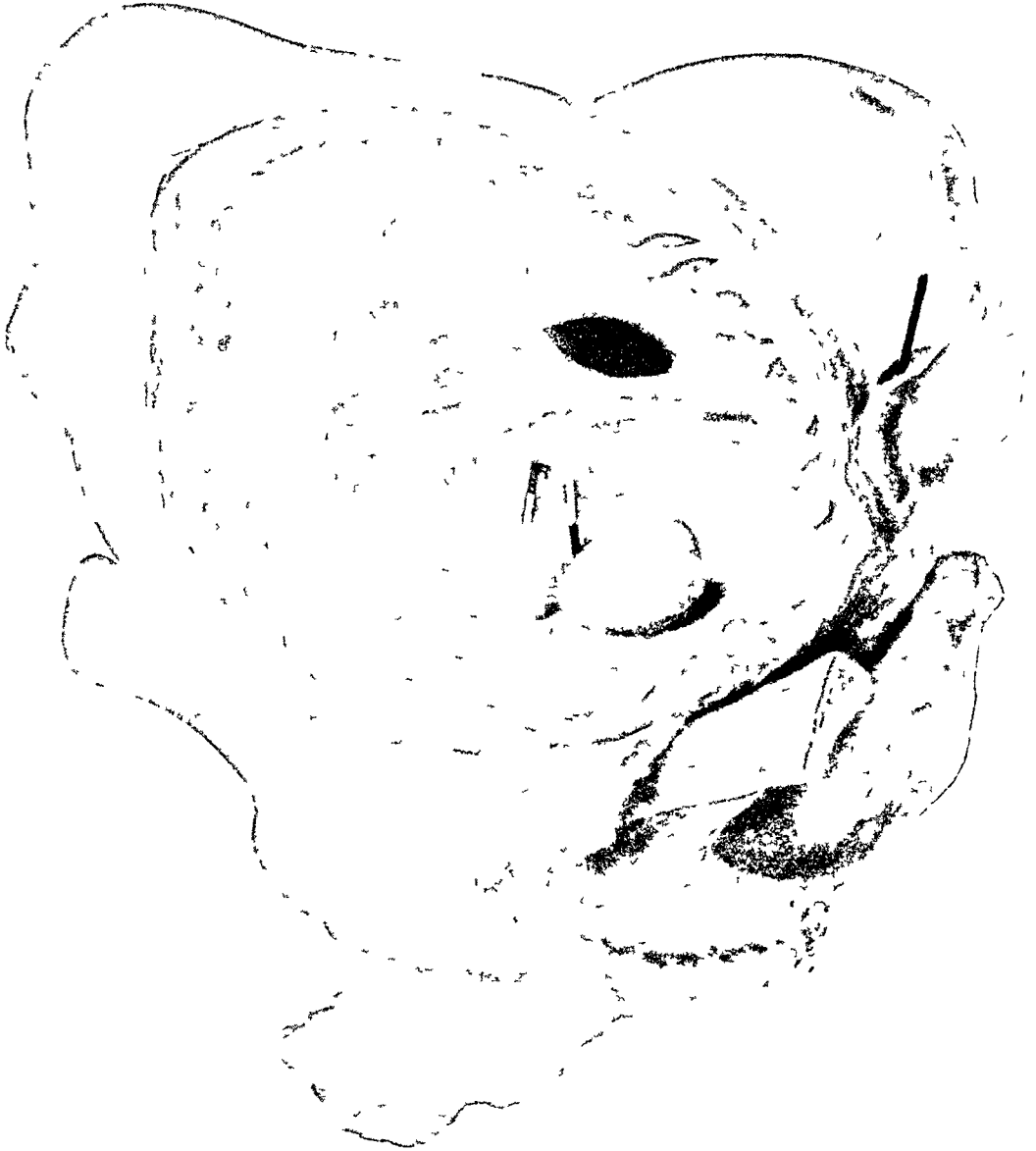
The value of these latter results is wherein they show the extent to which the patient's health was broken down prior to any surgical treatment, however simple, being adopted for the relief of the disease

Those statistics showing the mortality attending the treatment of prostaticism are not quoted by me to support the advocates of any of the alternative routes of operation employed and I do not ask that undue importance be attached to them. What to me appears to be of great moment is the fact that the mortality attending prostatectomy, as practised in general hospitals, has not shown in recent years that degree of reduction we might have been led to expect and what is of greater moment is that cases are occasionally seen that in the light of our present knowledge appear eminently to justify operative treatment. The operation proves simple and uncomplicated and still the patient dies from causes that would appear to be virtually unavoidable

CAUSES OF DEATH AFTER PROSTATECTOMY

From the records of Saint Thomas' Hospital, Page has constructed a statistical analysis of the cause of death after suprapubic prostatectomy, but space will not permit of my referring to his observations in detail. It is sufficient for our present purpose to mention that, of the 15 fatal cases examined by him, 10 died within a week of operation and the majority of these from an acute local infection or from acute suppurative nephritis. An analysis of the 68 fatal cases that have occurred in the hospital to which I am attached has given a very similar result and has gone to show that by far and away the commonest cause of death after suprapubic prostatectomy is septic absorption, arising out of the wound inflicted. And second, it has shown the fact, that the majority of cases of prostaticism operated on in the wards of a general hospital are extremely bad lives from the actuarial stand-point on account of the pronounced degree of chronic renal disease from which they suffer

FIG 41



Enlarged prostate forming intravesical projection. Note trabeculation of bladder from extreme muscular hypertrophy with diverticulum and dilatation of ureter

trophy or chronic lobular prostatitis already described (Fig 42-44)

Serial sections never reveal the presence of the ejaculatory ducts within it or of striped muscle fibres coating the space

A fatal issue may ensue even in such a case, however, a further opportunity be afforded of observing what the operation accomplished locally. In order to investigate this latter question, I have studied the pathology of eight fatal cases following prostatectomy. The pelvic viscera were hardened *in situ* and thereafter complete celloidin sections of the prostate bed and adjacent viscera were made and examined microscopically. For our present purpose, one typical case will be referred to.

The case was that of a man who suffered from typical prostatic dysuria from prostatic hypertrophy. The gland was extracted without difficulty. He died, however, on the fifth day from pelvic cellulitis, owing to infection through the space of Retzius. Fig 45 is a vertical median (sagittal) section traversing the prostate and prostatic urethra which was removed. Fig 46, a similar section of the prostatic bed left after removal. Fig 47 is a composite superimposed photograph with the gland replaced within the cavity from which it was extracted by operation. Owing to the contraction of the cavity of the prostatic bed, the photograph of the prostate had naturally to be reduced in size to permit of this. When Fig 46 showing the prostatic bed is examined, it will be noticed that the stretched internal vesical sphincter surrounds the upper vesical entrance to the cavity. The thick, smooth covering of the false capsule lining the space is visible. Microscopic examination shows this coat to consist of condensed prostatic tissue, consisting mainly of muscle fibres and fibrous strands with compressed and atrophied gland acini amidst the fibres. The ejaculatory duct is clearly shown traversing the posterior wall of the space from the seminal vesicles above. Below and behind the ejaculatory ducts, the compressed and atrophied posterior lobe is seen lying between the false capsule and space of Denonvillier.

The undamaged external vesical sphincter and recto-urethralis muscles are seen beneath the prostatic bed. Fig 47, where the tissue is superimposed within the cavity from which it was ex-

membrane covering the mass projecting into the bladder is scratched through without difficulty. The line of cleavage is easily found. The finger sweeps readily round the mass of tissue which is enucleated with celerity and in comfort, being held for an instant only when the tough mucous membrane of the urethra is being torn through. The bleeding at the time is in no way alarming, and is soon naturally controlled. The cavity or prostatic bed out of which the tissue has been extracted contracts at once to a size approximately half of that of the structure it previously contained. The prostatic bed is felt to possess a smooth lining and the inner vesical sphincter can be made out as a muscular ridge between the bed below and the vesical cavity above.

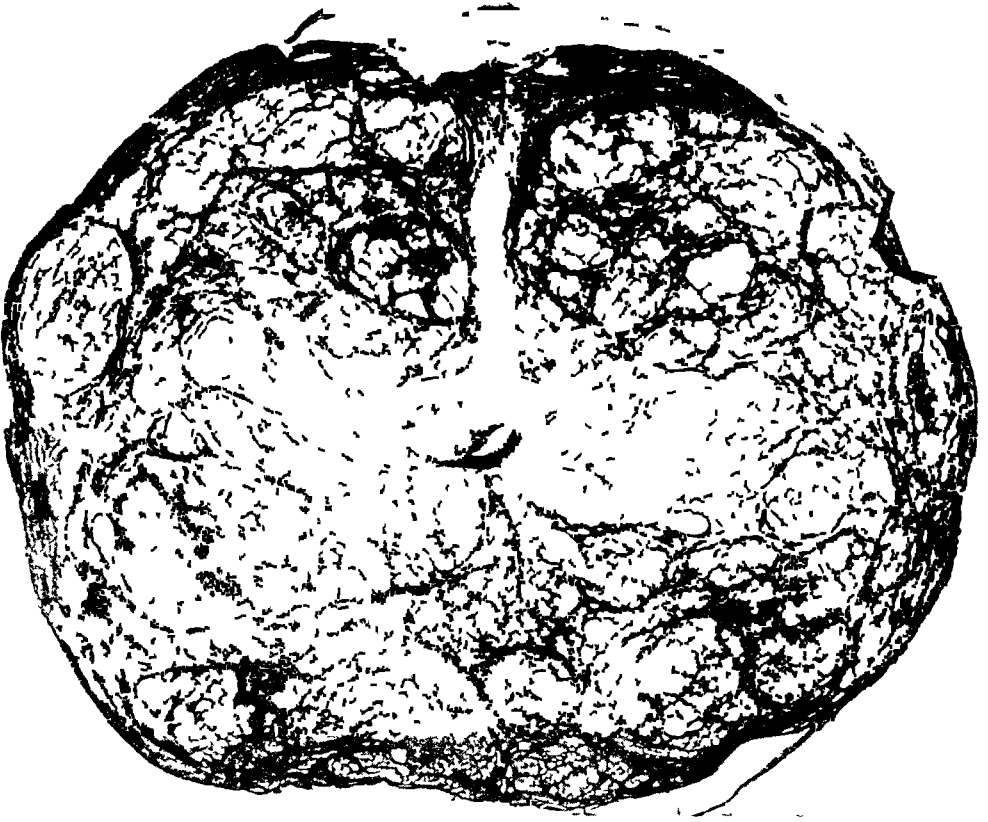
When the morbid anatomy of such a case dying without operation is examined, it will be noticed how nature would here appear to have designed the parts for the performance of suprapubic prostatectomy.

The main bulk of the gland forms an intravesical projection covered by a thin and atrophied mucous membrane (Fig 41). The internal vesical sphincter is dilated and crushed into a region of safety and surrounds the base of the intravesical mass (Fig 21). Damage to it is virtually impossible.

The line of cleavage between the false capsule formed by the condensed uninvolved prostatic tissue and the diseased lobes is distinctly defined by the flattened and atrophied gland acini which form the ring of "postage stamp" perforations that have already been described in referring to the morbid anatomy of the disease (Fig 23). The process being confined to the middle and lateral lobes, the ejaculatory ducts and posterior lobe are displaced into a region of safety and are separated from the area of hypertrophy by the thick-walled, false capsule. This latter membrane also serves as a thick protecting coat to the large blood sinuses lying between the sheath and true capsule (Fig 24). The external vesical sphincter is also safe from any possible source of damage.

When the tissue removed in such a case is examined it will be noticed to possess the typical appearances of prostatic hyper-

FIG 42



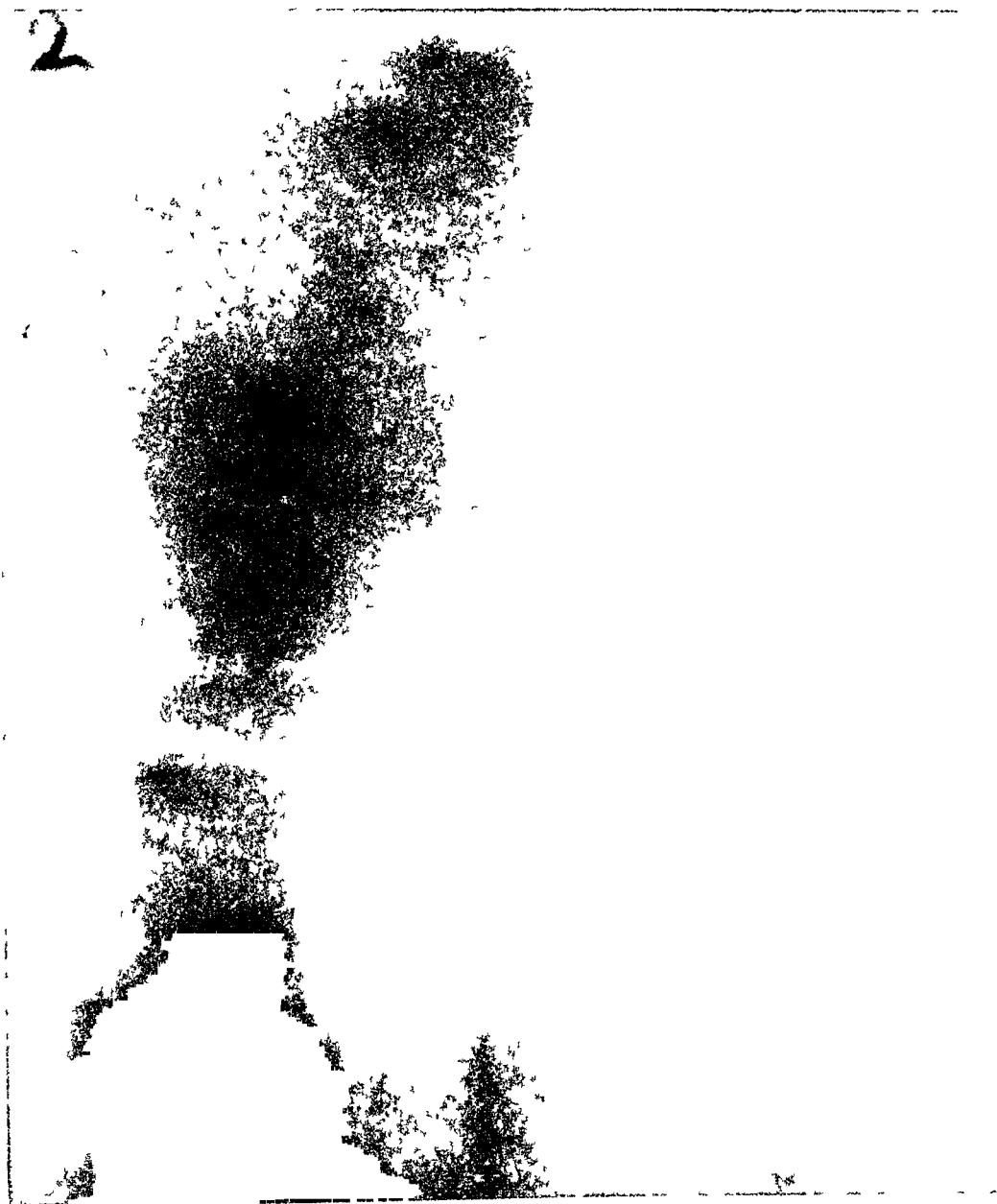
Horizontal section of prostate removed by suprapubic prostatectomy for chronic lobular prostatitis (prostatic hypertrophy) showing disease to be generalized and portions of false capsule

FIG 43



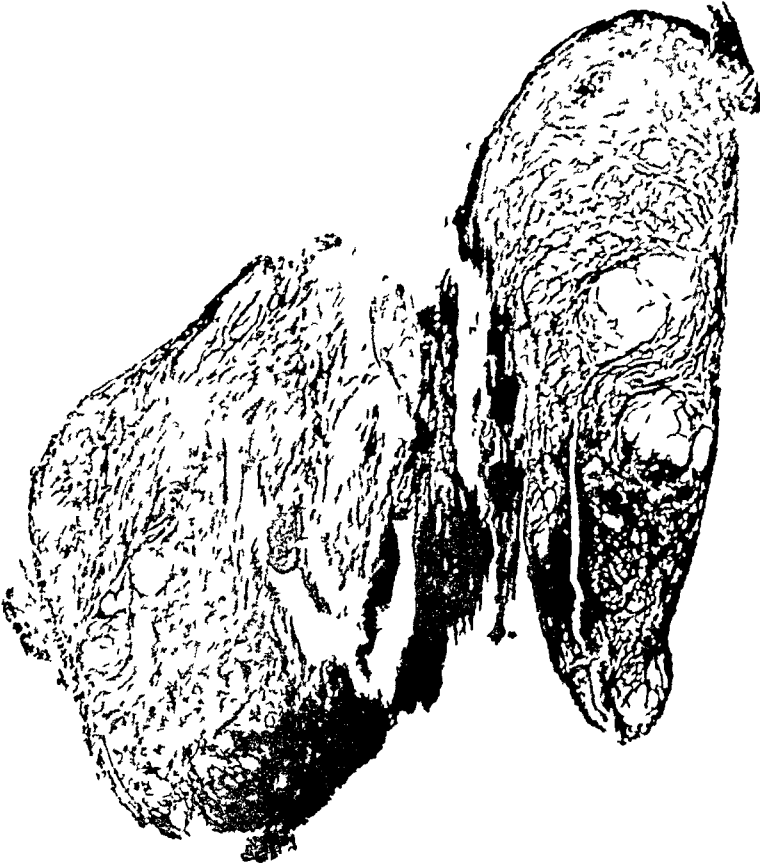
Horizontal section of prostate removed by suprapubic prostatectomy for chronic lobular prostatitis (prostatic hypertrophy) showing numerous thin-walled retention cysts where disease is advanced

FIG 3



CASE IV. Radiograph 24 hours after barium meal showing obstruction just above the hepatic flexure. The entire mass of barium is in the cecum and ascending colon.

FIG 45



Median sagittal section prostate removed by suprapubic prostatectomy 'total' enucleation for chronic lobular prostatitis (prostatic hypertrophy) Note section traverses prostatic urethra and shows thin mucous membrane covering middle lobe

Horizontal section of prostate removed by suprapubic prostatectomy showing advanced chronic lobular prostatitis (prostatic hypertrophy) with numerous large retention cysts



Fig 44

FIG 48



Sagittal section of prostatic bed in midlateral plane showing situation and structure of false capsule lining prostatic bed and relationship of seminal vesicles and posterior lobe

Suprapubic prostatectomy, total enucleation, supraposition photograph made from Figs 43 and 40, the prostatic beams, replaced within the prostatic bed



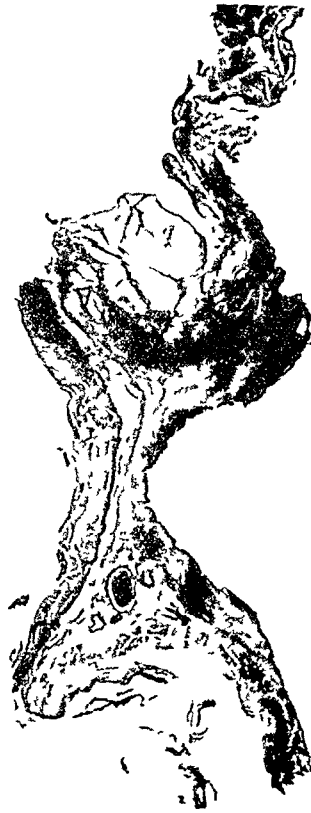
Fig 47

Median sagittal section of prostatic bed from patient dying on the fifth day after suprapubic prostatectomy, total enucleation showing dilated internal vesical sphincter, false capsule, conservation of ejaculatory ducts, posterior lobe and external vesical inter (Figs 43 and 40 from same case)



Fig 40

FIG 58



Coronal section of lateral wall of prostatic bed after suprapubic prostatectomy showing thick false capsule containing numerous septic thrombi

Sagittal section of prostatic bed, rectum and urethra after suprapubic prostatectomy show
ing false capsule and portions of tissue remaining after nodular removal



FIG 56

Vertical section of tissue adherent to apex of prostate removed by suprapubic prostatec-
tomy (Fig 31) showing urethra and portions of external vesical sphincter



FIG 57

tracted, conveys in a manner more lucid than verbal description, the exact nature of the operation, where a "total" enucleation of the prostate gland is accomplished by the operation of suprapubic prostatectomy

Even in the case above described, serial sections showed that, at the margin of the lateral lobes, nodules of diseased prostatic tissue had remained behind within the false capsule (Figs 48-50)

2 *Total Enucleation with Conservation of the Prostatic Urethra by Suprapubic Prostatectomy*—The determining factor in this operation is the consistence of the anterior commissure. Where there is situated in front of the urethra a mass of tissue tough in consistence and virtually devoid of disease, the finger is deflected naturally toward the urethra as it passes over the front of the gland and sweeps behind the urethra conserving it wholly or in part in consequence

In such cases, it will usually be found that the lateral lobes are not widely involved in the disease which is mainly confined to the middle lobe

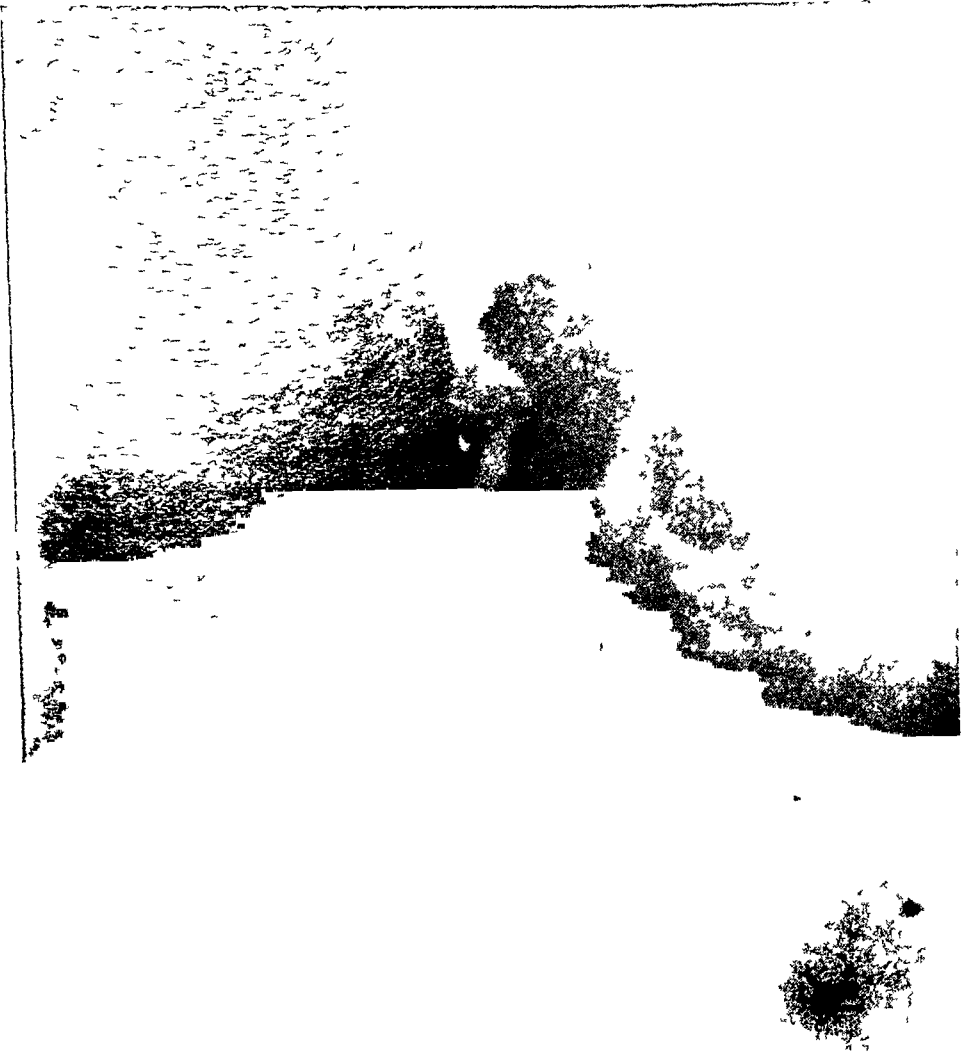
Horizontal sections of specimens from such cases show a typical horseshoe contour (Fig. 51)

3 *Lobar Enucleation*—The nature of the false capsule formed by the disease is the determining factor in such cases. In those cases where the morbid process is more lobar than lobular a thick false capsule surrounds the lobes and their separate enucleation is most easy and most likely to be accomplished (Fig. 22). The appearance in sections of the tissue removed is characteristic (Fig. 35)

4 *Nodular Enucleation*—The nature of the false capsule is here again the determining factor in explaining the result achieved

In discussing the morbid anatomy of prostatic hypertrophy or chronic lobular prostatitis, it was pointed out that the change that led to the formation of the false capsule surrounding the gland was not confined to that region, but took place in a similar manner between individual spheroids. In those cases where the tissue removed is extracted in individual nodules

FIG 4



Case VI Radiograph 36 hours after bismuth meal showing angulation at hepatic flexure and marked stasis

of varying size, it will be observed that the external false capsule is imperfectly formed and the finger is in consequence deflected into the lines of separation that pass into the gland and separate the individual spheroids (Fig 52)

It has already been mentioned that in addition to the case already described, the pelvic viscera of seven other cases that died after the operation of prostatectomy were hardened *in situ* and serial sections made of the prostatic bed and neighboring viscera. Certain of these illustrated some of the complications with which the operation may be associated

Fig 53 shows a traversed section of the parts left after removal and shows fragments of diseased prostatic tissue that have remained adherent to the false capsule, and illustrates how the false capsule had been lacerated at the time of operation and the space between the true capsule and sheath opened into. The effect of this was shown at the post-mortem examination in the large amount of extravasated blood that had infiltrated the pelvic cellular tissue, extending up over the posterior surface of the bladder into the retroperitoneal connective-tissue planes. The patient died from pelvic cellulitis, the infecting bacteria having gained entrance through the torn false capsule

Sections from the same case (Fig 54) at a lower level show the manner in which the ejaculatory ducts are conserved and come to open into the large prostatic bed. It also demonstrates the posterior lobe that remains after removal, lying between the ejaculatory ducts and the space of Denonvillier, and how in this case large parts of the lateral lobes were similarly uninvolved by the disease, and remained behind after enucleation

A further section from this case made at a still lower level (Fig 55) demonstrates the relationship of the blood-vessels in the sheath after prostatectomy, showing how they are protected by the thick layer forming the false capsule and the uninvolved prostatic tissue

In only one of the eight cases examined were the ejaculatory ducts found to be seriously damaged. In five of the eight, the false capsule was torn and the pericapsular space infiltrated with blood and infected

The appearances seen in one case, where a nodular removal was practised are illustrated in Fig 56. Numerous fragments of diseased prostatic tissue have been left and are seen projecting into the prostatic bed. In such a class of case, it is not difficult to account for the liability for the obstruction to recur after the operation is recovered from

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Microscopical examination of the prostatic bed of the eight cases showed it to consist of muscle and fibrous tissue and compressed gland acini as already described and in all cases it was the site of an acute suppurative process. In all cases, small septic thrombi were present in the smaller vessels and in two cases large septic thrombi were also present in the large veins of the prostatic sinus (Fig 58)

The question may now be considered whether a total extracapsular complete enucleation of the prostate gland is ever accomplished by blind finger dissection in the course of the operation of suprapubic prostatectomy. In certain anatomical text-books, the student is led to believe that this is what the surgeon aims at and usually accomplishes.

Thus, for example, the most popular student text-book of anatomy states

Immediately surrounding the prostate, and quite independent of the sheath, is the fibrous capsule of the prostate. This capsule varies in thickness, in some cases being extremely thin, in others forming a distinct cortex. In association with operations for the removal of the prostate now frequently performed, it is important to notice that the capsule has but very slight connection either with the venous plexus or with the sheath of pelvic fascia. It is on this account, that the gland can be so easily shelled out from its surroundings.

So far, I have only obtained one specimen of this nature. It was presented to me by a graduate, and in addition to the complete prostate, the seminal vesicles had been removed along with portions of the vasa deferentia, which hung like tentacles to the specimen. When the specimen was sectioned, it showed the gland to be the site of chronic interstitial prostatitis. I was informed that it was removed with the utmost difficulty. This was not surprising. No further history was obtainable.

Cases are, however, not rare where a partial extracapsular removal has been carried out. In the operating theatre, these are difficult cases, and when the specimen is examined after removal portions of striped muscle fibre are found on its surface, and a portion of one of the veins of the prostatic sinus may be adherent (Fig 31).

From the lower apex of the gland a tongue of tissue fre-

quently projects which contains muscle fibres derived from the external vesical sphincter (Fig 57) These are usually either cases of diffuse chronic lobular prostatitis, where no spheroids are formed, or combined lobular and interstitial prostatitis, or, as in Fig 31, cases of early carcinoma The case from which this last specimen was obtained terminated fatally, and the post-mortem examination showed the false capsule to have been torn, and early secondary carcinoma present in the lymphatics

I have not had the opportunity of examining post mortem a case of fibroid prostatitis treated by prostatectomy If, in such a case, the prostate is enucleated, it is easy to deduce what is likely to result from what has been already described as the morbid anatomy of this disease,

THE LOCAL RESULTS OF PROSTATECTOMY—CONSERVATIVE PERINEAL OPERATION OF YOUNG

In discussing the results of Young's operation, the surgeon has the advantage in that, he is afforded at the time of operation a full view of the dissection he executes, consequently, the same dubiety as to the structures divided and removed does not exist The material examined by me was obtained from ten cases all of which were operated on by myself When the tissue removed was sectioned and examined microscopically it showed the lobes to be masses of tissue, the site of chronic lobular prostatitis, and demonstrated the fact that the lobes were the product of no natural anatomical division of the gland but resulted from the separation of a common mass of diseased tissue into three more or less artificial divisions

THE CHOICE OF OPERATION BASED ON THE PATHOLOGY OF THE DISEASE WITH ESPECIAL REFERENCE TO THE RELATIVE ADVANTAGES OF SUPRAPUBIC AND PERINEAL PROSTATEC- TOMY

In discussing this question, we are met at the outset by the opinion already expressed when considering the pathology of certain "ideal" cases of advanced chronic lobular prostatitis,

Microscopical examination of the prostatic bed of the eight cases showed it to consist of muscle and fibrous tissue and compressed gland acini as already described and in all cases it was the site of an acute suppurative process. In all cases, small septic thrombi were present in the smaller vessels and in two cases large septic thrombi were also present in the large veins of the prostatic sinus (Fig 58)

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From the lower apex of the gland a tongue of tissue fre-

peritonitis, (5) uræmia In cases, where the damage to the kidneys before operation was so severe, that, in the absence of other complications, this revealed itself as the sole cause of death

The underlying cause, common to all, is thus the weakened power of resistance owing to the prolonged disease

The dangers that are peculiar to suprapubic prostatectomy in an "ideal" case are the wounding of the space of Retzius and the consequent risk of septic pelvic cellulitis and the risk of pulmonary infection with hypostatic congestion and pneumonia that is present when an elderly patient is confined to bed for some time as is the general practice after suprapubic prostatectomy The third risk is the difficulty of providing an efficient drainage of the bladder and prostatic bed so as to prevent a profound septic absorption from the stagnant septic urine that bathes the raw surface of the latter

We may now ask how far these factors are avoidable by the choice of other means of treating the disease The choice at our disposal lies between catheter life, the performance of a preliminary suprapubic cystotomy, and perineal prostatectomy Catheter life may be dismissed at once as only justifiable in the hopelessly inoperable cases of this type Preliminary suprapubic cystotomy is favored by some on the grounds that it permits of a certain improvement in the patient's condition prior to the removal of the growth and improves the condition of the septic bladder, but the value of it is doubtful Page has shown how the mortality attending this line of treatment is relatively as great as that attending suprapubic prostatectomy and it has further this disadvantage, that it does not get rid of the main risk of the operation where suprapubic prostatectomy is performed in an "ideal" case, which is pelvic cellulitis due to infection by way of the space of Retzius

A typical case is quoted below to illustrate this danger

He was a man of sixty-seven, upon whom a suprapubic cystotomy was performed with the intention of its being preliminary to a suprapubic prostatectomy On the night after operation, the

where it was said that nature would appear to have designed the parts for the operation of suprapubic prostatectomy. We will therefore consider the question from three stand-points (1) The factors contributing to the relatively high mortality met with in those "ideal" cases, when treated by suprapubic prostatectomy and how far it is possible to diminish this by the employment of other methods of operative treatment, (2) the local complication that may follow recovery after suprapubic prostatectomy in "ideal" cases of prostatic enlargement, (3) the danger of attempting to perform Freyer's operation of suprapubic prostatectomy in cases where the circumstances are not "ideal," the prostatism being due to other causes

When the first question is considered, the facts concerning the cause of death after suprapubic prostatectomy already mentioned should be borne in mind. It has been already shown that the "ideal" case was the large "adenomatous" hypertrophied prostate, the site of chronic lobular prostatitis, where a large intravesical projection existed and a thick complete false capsule was formed. The damage to the patient's health during the period when this mass of tissue was ripening for removal has been also shown, the local and general irreparable damage caused by the prolonged backward pressure on the bladder and kidneys due to the retention of urine have been described. The case may be "ideal" for suprapubic prostatectomy, but the health of the patient has become so permanently impaired that any operation is now to him a most dangerous procedure.

The factors, that are liable to be the immediate cause of death in such a case have been shown to be (1) local infection arising out of the wound inflicted, for example, pelvic cellulitis, suppurative cystitis, consecutive suppurative nephritis and under this heading may be included also reactionary hemorrhage, (2) the development of a distal septic focus such as bronchopneumonia, (3) embolism, producing pulmonary infarction which is always due to an associated infection, (4) surgical accidents, such as fatal reactionary hemorrhage and

operation and the risk of infection of the pelvic cellular tissue planes owing to the opening of the lymph paths when the space of Denonvillier is opened into. This latter would appear, however, to be more a theoretical than actual danger as it has not been encountered by Young in his numerous cases and in my very limited experience of ten cases it has never been encountered. The reason for this would appear to be that the time when infection is liable to gain entrance to the cellular tissue is during the hours immediately following the infliction of the wound before nature has had time to create the natural protective barrier, and during this period in Young's operation the bladder drain and gauze packs in the prostatic bed prevent the entrance of septic urine in such quantity as to lead to a cellulitis. When the gauze packs and bladder drain are withdrawn by the end of the second day the free dependent drainage prevents septic material accumulating. The importance of this latter fact appears to me to be borne out in my limited experience where I have noticed how liable such patients are to have a slight rise of temperature and other indications of ill health about the end of the first week after operation, at that period when the external skin wound is closing but still a day or two before the urine comes by the natural channel. During this brief interval Denonvillier's space is liable to be distended with septic material for the first time during the course of operation. This passing phase of septic absorption, if my explanation be correct, bears out the well-known surgical dictum, "That man does not die from sepsis on a free surface, it is the confinement of sepsis that the surgeon fears after operation."

The avoidable risks peculiar to perineal prostatectomy are probably more dreaded by certain surgeons. The reality of them no one familiar with the operation will gainsay. None of them are, however, such as to be likely to lead to a fatal issue.

A "total" enucleation of the gland along with the prostatic urethra can, of course, be accomplished by perineal prostatectomy and blind finger dissection in the "ideal" case (Fig 59). To accomplish this the integrity of the floor of the

temperature rose to 103° and remained high for nine days, when it fell to 100° F. He complained chiefly of pain in the upper part of the abdomen, and died suddenly on the tenth day. The abstract of the pathological record is: Enlarged prostate, backward pressure, pyelitis, pelvic suppurative cellulitis, early bronchopneumonia. The detailed description of the pelvic viscera shows how the pelvic cellular tissue was infiltrated by a thick, greenish lymph which extended up into the retro-abdominal tissues. This area of purulent infiltration extended from the space of Retzius which had been wounded in the natural course of opening the bladder. The purulent infiltration reached as far as the lower pole of the right kidney. The prostate was increased in size, with a nodule of prostatic substance projecting into the cavity of the bladder behind the urethral opening and forming the so-called middle lobe of the prostate. This projection was covered with ulcerating bladder mucosa. The bladder wall was hypertrophied owing mainly to an increase in the muscular coat. The mucous membrane had undergone chronic ulceration and multiple villous-like projections of indurated mucous membrane projected from the surface. The ureters were somewhat dilated, their walls were hypertrophied, and their mucous membranes showed evidences of recent catarrh. The pelves of both kidneys were dilated and showed signs of recent acute catarrh. There was no evidence of suppurative nephritis, there was some chronic interstitial nephritis.

Where perineal prostatectomy according to Young's method is employed for the treatment of this "ideal" case it is of course associated with risks peculiar to itself, but with it there is naturally no risk of infection of the space of Retzius which is not damaged. The risk of pulmonary complications is much less, the patient being out of bed on the second or third day, and finally, every impartial critic will grant that where the technic of bladder drainage is carried out according to the directions laid down by Young, the drainage is as near "ideal" as is possible to achieve and there is no retention of stagnant septic urine in the bladder and prostatic bed.

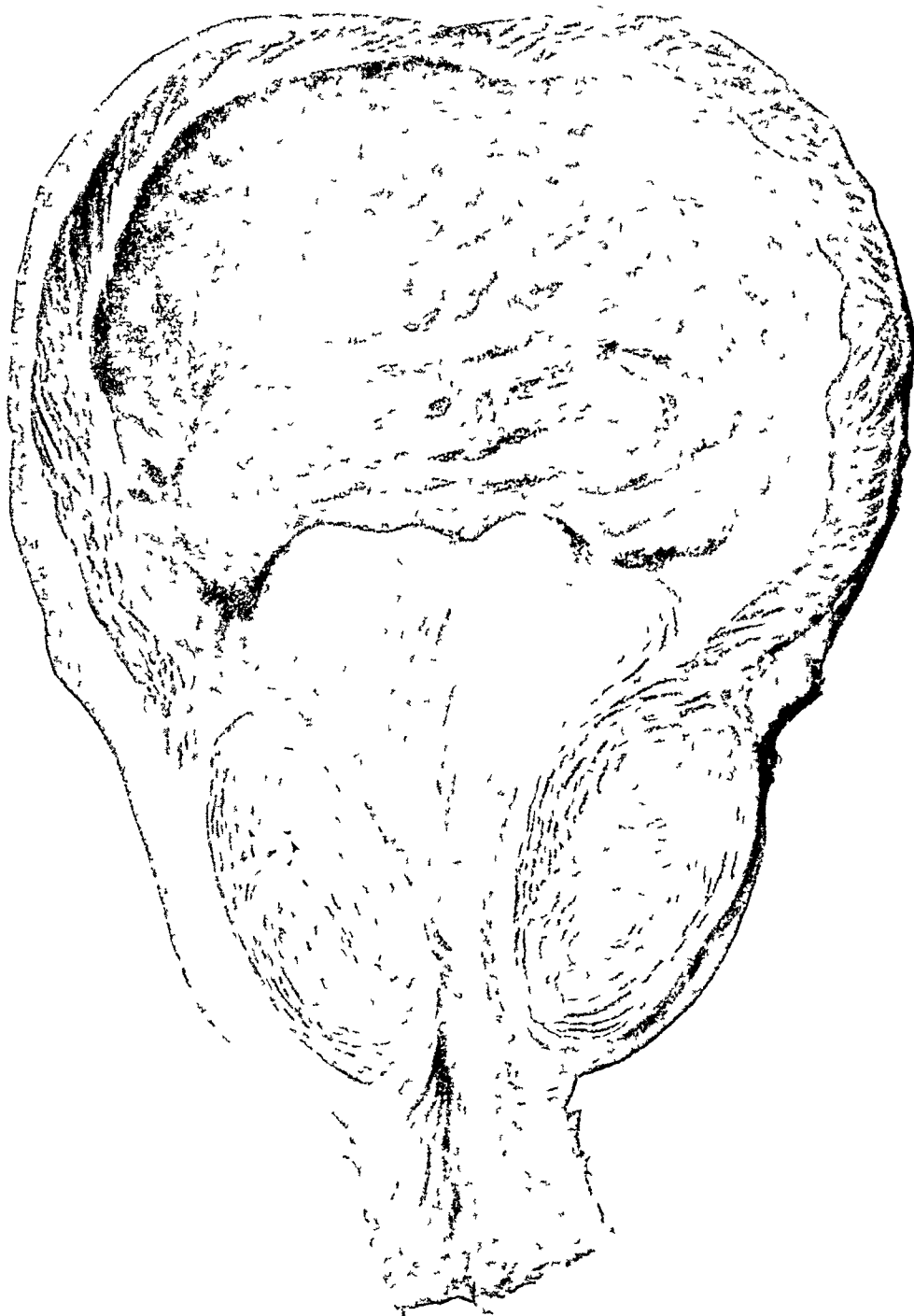
The unavoidable risks peculiar to Young's operation in such a case are the greater length of time occupied by the

FIG 59



Prostate removed by perineal prostatectomy total enucleation along with prostatic urethra

FIG 60



Bladder and prostate showing prostatic hypertrophy intravesical herniation with displacement of internal vesical sphincter

FIG 5



Case IX. Radiograph 38 hours after bismuth meal. Note sharp angulation in proximal third of transverse colon. At operation a Jackson's membrane was found which held together the descending and ascending limbs of this angulation. Upon division of this membrane the intestine unfolded as it released from a bag.

prostatic bed must be destroyed and Denonvillier's space with its contained lymphatics opened. This operation possesses those advantages that a perineal cystotomy does over a suprapubic cystotomy. Where a median incision is employed and the case found to be one that does not permit of the gland being enucleated by the unaided finger the surgeon may enlarge the wound and excise the gland by visual dissection. The operation has certain obvious disadvantages. The confined space necessitates a longer and more difficult operation. The external vesical sphincter of the prostatic bed must be damaged. Denonvillier's space is opened as an unguarded path of infection. The only advantage it possesses over Young's operation is a wound that is slightly smaller and an operation that is slightly more expeditious. On the other hand, the damage that may be produced by blind dissection in this region is necessarily very much greater than is the case where the dissection is executed by sight. On these grounds, I do not think it necessary to refer further to it as, where the perineal route is employed, Young's operation will be found in all cases to be the best to employ.

II. THE LOCAL COMPLICATIONS FOLLOWING RECOVERY AFTER PROSTATECTOMY IN "IDEAL" CASES OF PROSTATIC ENLARGEMENT

The complications that are usually considered as liable to occur are

(1) *Incontinence of Urine*—This is considered to be especially liable to follow perineal prostatectomy. Young, however, has not had one case of complete incontinence after operation. He has had three cases of troublesome diurnal incontinence and four of nocturnal incontinence. It is considered as less likely to follow suprapubic prostatectomy and from what we have already seen such is naturally to be expected. McDonald in his analysis of the cases operated on in St Peter's Hospital mentions three cases. In none did permanent incontinence remain. If suprapubic prostatectomy is combined with perineal drainage permanent incontinence may

(6) *Formation of Calculi in Bladder or Prostatic Pouch* —

This is a complication that occasionally arises. Its relative frequency after suprapubic or perineal prostatectomy is uncertain.

(7) *Recto-Urethral Fistula* — This serious complication is especially liable to arise after a perineal operation. Its possible occurrence appears to have strongly prejudiced some surgeons against this route. It is by no means so common as is supposed. Young has observed it four times in 450 cases. Its prevention lies in a knowledge of certain anatomical relationships that have already been demonstrated.

The position as regards the operative treatment of the "ideal" case of prostatic hypertrophy due to chronic lobular prostatitis may therefore, be briefly stated to be that the simplest, most rapid, and, speaking broadly, the safest method of treatment is Freyer's operation. When it is performed, it is of the utmost importance that the skin wound should not be sutured so as to minimize the risk of prevesical infection. Efficient drainage of the bladder and getting the patient out of bed as early as possible are of equal importance.

Perineal prostatectomy in such cases, in skilful hands, may produce an equally good result, but is more liable to be followed by such post-operative complications as stricture, fistula, or partial incontinence. In the hands of those unfamiliar with the accurate steps of the operation and its after-treatment, it is a much more dangerous method of treatment for this class of case. Thus on practical grounds, we may reaffirm that nature would here appear to have designed the parts for the operation of suprapubic prostatectomy.

THE OPERATIVE TREATMENT OF CASES OF PROSTATISM WHERE THE DISEASE IS NOT IDEAL FOR SUPRAPUBIC PROSTATECTOMY

We have seen how in this class there is included (1) cases of chronic lobular prostatitis or prostatic hypertrophy without glandular enlargement, (2) cases of chronic lobular prostatitis

~~clap~~ Fullarton has recorded such a case. The risk in such a case lies in the destruction of the dual sphincter that guards the bladder in a manner we have already seen. In citing those statistics, it is only fair to remember that many of the cases were not of the "ideal" type of disease that we are at present considering.

(2) *Return of Obstruction*—This is usually due to incomplete removal of the disease and may develop in any case. Where the circumstances are ideal for suprapubic prostatectomy and the whole area of disease in consequence removed, the likelihood of this occurrence is most remote. It is, if anything, more likely to follow perineal prostatectomy in such cases.

(3) *Loss of Sexual Power*—This is considered as especially prone to develop after perineal prostatectomy and is accounted for by the damage to the ejaculatory ducts. If these are conserved and the zone on the floor of the urethra and around the verumontanum preserved it can be avoided. This danger may be considered to be non-existent where suprapubic prostatectomy is performed in an "ideal" case. We have seen how nature in such cases carefully protects the ejaculatory ducts and verumontanum from damage. It is even claimed that the sexual vigor may be increased after suprapubic prostatectomy in certain cases and when the relief from pressure on the seminal ducts that follows the operation is realized, it will be apparent that this claim is quite rational.

(4) *Persistence of Vesical Fistula*—This may occur in either operation. It is probably more common in the perineal operation.

(5) *Epididymitis*—This would appear to be more common after suprapubic prostatectomy. McDonald examined 118 such cases, 14 of these suffered from epididymitis prior to operation, 27 developed it in hospital after operation. In 4 it arose after leaving hospital, a percentage of 27.75. The explanation of the relatively greater frequency of this complication in suprapubic prostatectomy would appear to be the less efficient drainage that is the rule with this operation.

seek in another operation a satisfactory means of treating such cases

The risks associated with the second course where suprapubic prostatectomy is practised in the types of disease mentioned are numerous and have been already referred to. Thus, in chronic interstitial prostatitis and advanced carcinoma the operation is practically impossible. Its attempted performance is advised by no surgeon of standing, but, at the same time, cases have occurred where it has been attempted and I have referred to one where a complete extracapsular removal of the entire gland was achieved by this means. The dangers of such a procedure are too obvious to warrant repetition.

Where glandular hypertrophy without intravesical projection is present, it can of course be diagnosed by cystoscopic examination, or better still examined with an urethroscope, such as Wossidlo's, or a cysto-urethroscope. I am afraid, however, that in many cases, it is only when the bladder is opened that the condition is discovered. Suprapubic prostatectomy in such a case necessitates damage and probably destruction to the internal vesical sphincter. It is likely also that in these cases the line of cleavage between the area of disease and false capsule will be more difficult to find. The result is, the operation is much more difficult and the extracapsular lymph space will probably be opened into and the grave risk of septic pelvic cellulitis encountered in consequence.

There remains last the case where the false capsule is imperfectly formed, to be considered. I claim to have already shown that these cases are occasionally met with and we have seen how when suprapubic prostatectomy is done in such cases the tissue is removed, usually in fragments with the risk of leaving portions as possible future causes of obstruction. In this class of case again the dangerous lymph area between the capsule and sheath may be opened into.

We may, therefore, consider that in all the classes of cases mentioned Freyer's suprapubic prostatectomy is unsuitable

without intravesical projection, (3) cases of chronic lobular prostatitis without the formation of a complete false capsule, (4) cases of chronic interstitial prostatitis where the disease is generalized, or has led to the formation of a median prostatic bar, (5) cases of carcinoma of the scirrhus type or involving the capsule

The danger of attempting to perform Freyer's operation in such cases is known to every surgeon who has endeavored to do it. At the same time, it should be remembered that Freyer's position as regards such cases is perfectly clear. In speaking of cases suitable for suprapubic prostatectomy he says

"In patients in the earlier stages of the malady in whom not more than an ounce or two is found on introducing the catheter, it is inadvisable to attempt the removal of the prostate because the enlargement of the organ will not have sufficiently advanced to render it prominent in the bladder or to define adequately the lines of cleavage between the true capsule of the prostate and its enveloping sheath. When we have to deal with adenomatous enlargements of smaller dimensions, say less than $1\frac{1}{2}$ ounces in weight, the greatest difficulties present themselves as to the possibility of their enucleation entire being practicable"

It is important to bear in mind, however, in addition to early cases with a smaller quantity of urine the most pronounced cases of prostatism with the severest degree of backward pressure are frequently met with in cases where the prostate is not enlarged or only slightly so and where the gland in consequence maintains its normal relationship to the surrounding structure

In treating such cases, therefore, the courses open to us are (1) to delay and wait for the gland to ripen to the maturity necessary for the satisfactory performance of suprapubic prostatectomy, a procedure surely unwarranted as a sound surgical practice in the light of the damage done to the urinary tract and the whole body by delay, (2) to endeavor to enucleate the gland by suprapubic prostatectomy, (3) to

lobular prostatitis with general enlargement without intra-vesical projection or with an imperfectly formed false capsule the dual sphincter can always be conserved. The absence of the false capsule will of course render the removal more difficult, but as this is an operation whose technic is that of a visual dissection and not a blind finger enucleation, as in the suprapubic operation, this difficulty is not anything like so serious. Further, the wounding of the extracapsular lymph space which is liable to occur and was referred to as a serious complication in the suprapubic operation is not here of serious consequence, because, owing to the reasons already given, the space is not liable to the same degree of septic infection and the drainage it receives is so thorough as to mitigate against the risk of cellulitis arising from this cause. If the large veins beneath the sheath are wounded the bleeding vessel can be seen and controlled by ligature and serious hemorrhage thus prevented.

The treatment of carcinoma by perineal prostatectomy has been shown by Young to be possible even in those cases where the capsule and base of the bladder are invaded. If the tumor is adherent to the rectum behind, the risk of damage to the bowel is correspondingly very much increased. Young has removed the entire gland along with the seminal vesicles and a portion of the bladder floor, a procedure impossible by the suprapubic route. It is only fair, however, to remember when considering the treatment of prostatic carcinoma that in many cases the disease when early has been removed with ease by Freyer's operation. This has, however, been accomplished when the malignant nature of the growth was clinically unsuspected and, usually, owed its success to the co-existence of chronic lobular prostatitis, upon which the malignant process had supervened. This latter fact is a further reason for advocating early operative interference in all cases of prostatic dysuria and it does not directly influence the question of the treatment of the disease when clinically recognizable. I think most will agree that in the light of the pathology of prostatic carcinoma and the results obtained by Young, Willan's advice as given in his

III THE OTHER OPERATIVE PROCEDURES SUITABLE FOR THESE CASES.

Those comprise (1) perineal prostatectomy, (2) division of the median bar by Bottini's galvano-cautery, or its modifications, or by Young's more recently introduced prostatic punch, (3) suprapubic transvesical prostatectomy by the transperitoneal route or extraperitoneal with visual dissection

The scope of the second variety of operative treatment where the cautery or punch is used is clearly defined. They are the procedures of choice for cases of chronic interstitial prostatitis, especially with median bar formation

Perineal Prostatectomy—Cases of chronic lobular prostatitis (prostatic hypertrophy) without glandular enlargement are particularly suitable for this operation. In this type of disease, the false capsule was well formed in the cases I have examined. The entire gland, however, is situated below the bladder floor and separated from that cavity by its mucous and muscular coats

By means of the operation of perineal prostatectomy, if properly executed, the area of disease may be entirely removed without damage to the internal or external vesical sphincters. If, at the same time, the surgeon, following Young's instructions, cuts deeply into the individual lobes by the incisions made parallel to the course of the prostatic urethra the compressed tissue of the posterior lobe will be divided and the line of natural cleavage reached that allows of the easy removal of the diseased tissue in the separate portions described as lobes by Young. It has appeared to me that the importance of making this incision of a necessary depth in all cases where Young's operation is performed, so that the posterior lobe is divided completely, is perhaps not always fully appreciated when this operation is performed and it is rendered much more difficult in consequence owing to the natural line of cleavage not being reached by the shallow cut made

Where perineal prostatectomy is done for cases of chronic

recent article is unduly pessimistic, when he recommends that where a diagnosis of cancer of the prostate has been made clinically the performance of a radical operation for the removal of the disease is not to be recommended. When 20 per cent of cases of prostatic enlargement or obstruction in old men are recognized as due to carcinoma such advice is surely unwarranted.

Suprapubic Transvesical Prostatectomy by the Open Method—This method of treating prostatic disease is being more generally practised in recent years. It is possible that when visual accurate dissection has replaced blind enucleation an "ideal" operative technic for the treatment of the above varieties of prostatic disease may be elaborated by this route.

Accurate removal and perfect control of hemorrhage would thus be possible. On the other hand, however, it is obvious that if the route is transvesical it must necessitate serious damage to the bladder in many cases to reach an organ that is frequently entirely extravesical in situation. How far this can be made good by reparative plastic surgery as a final procedure in the technic of such an operation can only be conjectured.

The conclusions as regards the treatment of prostatism from the stand-point of the pathology of the diseases causing it appear to me to be

1 Three outstanding varieties of disease lead to prostatism (a) Prostatic hypertrophy or chronic lobular prostatitis, (b) prostatic fibrosis or chronic interstitial prostatitis, (c) prostatic carcinoma

2 The first is by far the commonest cause of prostatism and was present in 82 per cent of the specimens examined

3 Chronic lobular prostatitis is in my opinion a senile hyperplasia, an aberrant overgrowth of tissue that is not the result of the appearance of an independent new growth, but is liable to develop into the same

4 Chronic lobular prostatitis in the majority of cases produces prostatic hypertrophy

19 For its successful performance an accurate knowledge of the anatomical structure and relationships of the prostate are necessary as well as an understanding of the pathology of the disease

20 The suprapubic transvesical method of prostatectomy by visual dissection offers the prospect of developing into a method of treating prostatism that may ultimately warrant its adoption in a large number of cases

21 Chronic interstitial prostatitis is best treated by division and removal of the constriction by the transurethral route

22 Prostatic carcinoma may be in an early case clinically indistinguishable from hypertrophy due to chronic lobular prostatitis

23 This fact is therefore a further reason for early operation in all such cases

24 Prostatic carcinoma when recognized clinically may be successfully treated by excision of the gland in suitable cases

I desire to record my gratitude to the President and Fellows of the Royal College of Surgeons of Edinburgh, in whose laboratories this research was conducted

I wish to thank also many of my senior colleagues, and especially Mr David Wallace, for permitting me to use material from their private and hospital cases, and Dr Shennan and the staff of the Pathological Department of the Royal Infirmary of Edinburgh, for the many willing services they have done for me in the course of this investigation

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5 It virtually always develops in the middle lobe and is almost uniformly confined to the middle and lateral lobes.

6 The gland in consequence undergoes changes that usually permit of its easy removal by suprapubic prostatectomy

7 Chronic lobular prostatitis may develop in and be confined to the anterior lobe, this being noted by me in one case

8 Chronic lobular prostatitis may cause prostatism without enlargement of the organ, intravesical herniation or complete false capsule formation

9 In these cases the performance of suprapubic prostatectomy is difficult and dangerous

10 The successful performance of suprapubic prostatectomy depends on the presence of an advanced type of prostatic hypertrophy due to chronic lobular prostatitis

11 The recognition of this is clinically frequently very difficult

12 When a patient with this advanced type of disease is operated on his urinary tract and general health have usually suffered serious damage from the disease

13 It is therefore unjustifiable to delay operation in an early case of chronic lobular prostatitis in order to permit of the gland undergoing those hypertrophic changes that facilitate its easy removal by suprapubic prostatectomy

14 The mortality attending suprapubic prostatectomy is mainly due to the impaired health of the patient prior to operation

15 The actual cause of death in such cases is usually a local infection arising out of the wound inflicted

16 The operation of suprapubic prostatectomy by blind enucleation is unsuitable in cases of prostatism due to other causes than advanced chronic lobular prostatitis

17 Perineal prostatectomy is a most suitable operation for such cases

18 Perineal prostatectomy permits of the removal of the disease when its presence is diagnosed in all cases. It is, therefore, at present the operation that offers the best prospect of further advance in the treatment of prostatism

SUPRAPUBIC VERSUS PERINEAL PROSTATECTOMY *

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FOR relief from distressing symptoms and imminent peril, few operations can rival the successful removal of the enlarged prostate obstructing the urinary outlet. The dangers and disadvantages of catheter life are well understood. The average expectancy of life for those entirely dependent upon the catheter has been estimated at two and a half years. Squier has recently reported 17 cases in his own observation who were dependent upon the catheter. Of these, 14 had died with an average duration of life of two years and ten months after commencing catheter life. Twelve of these died from suppurative renal lesions.

This only bears out the fact that catheterism, even as performed at present in the full knowledge of the dangers of infection and the means of prevention, is an exceedingly risky state and should cause us to ask the sharp question whether the man who still advises the catheter in this condition should be ranked truly as a conservative or as a dangerous radical. Even granting a mortality of four to ten per cent in the operation of prostatectomy, the average expectancy of life under operation greatly exceeds three years. Freyer recently had the satisfaction of seeing three of his first four cases of complete prostatectomy alive and well at the end of eleven years. The great difficulty with the catheter life is the possibility, in any but the exceptional case, of observing the necessary precautions to prevent infection of the bladder.

The cleanest catheterization *may* result in bladder infection,

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could see the philosophy of breaking through the roof of a house when you could get in through the cellar door "

At about the same time, approximately twenty years ago, Goodfellow (1891) performed the first total perineal prostatectomy and Eugene Fuller (1894) removed the gland entire by the suprapubic incision. The immediate importance and success of complete prostatectomy intensified the strife as to method, the choice of route being the most discussed feature of the operation and in many cases, we fear, almost overshadowing the results of the operation itself. We are only now beginning to get the necessary perspective by which to value the operation and the various methods of its performance. We can discern three distinct swings of the pendulum, first, toward the suprapubic operation, second, toward the perineal route, and now again a very decided trend almost everywhere toward the suprapubic approach. Set over against each other as the protagonists of the two extremes we find Freyer, of London, confining himself to the suprapubic operation and Young, of Baltimore, adhering equally rigidly to the perineal method, the success of which owes so much to him in his development of the earlier methods of the Frenchman, Proust.

The most important single criterion by which an operation is to be judged is mortality. "All that a man hath will he give for his life." The safest surgery compatible with the attainment of the necessary object is the best surgery. If it can be shown that one or the other of these two rival operations possesses an undoubted superiority in the matter of safety then certainly the claims of the more dangerous operation must fall to the ground since it is conceded that the prostate can be enucleated by either method. The advocates of perineal prostatectomy have not been slow to take advantage of the mortality argument. Young's mortality in the latest report which I have seen was slightly over 4 per cent. Freyer in 1912 reported 1000 suprapubic operations with a total mortality of $5\frac{1}{2}$ per cent. Examining these statistics more carefully we find that Freyer was able to report in his last 100 cases only

dirty catheterization is *almost certain* to do so. In spite of all this cases are known to have lived for 15 to 20 years or more after beginning the use of the catheter. These are the exceptions which prove the rule. I have now a case under observation who has complete retention of urine. He is a man over seventy-five years of age, and otherwise in robust health. Since his first attack of complete retention fifteen months ago, he has been entirely dependent upon an indwelling catheter which is changed once a week. He suffers practically no inconvenience, urination being at normal intervals and controlled during the meantime by a cork in the catheter. The catheter is replaced each week by a physician, the greatest care being exercised to prevent the introduction of infection. The bladder is irrigated once a week with a solution of protargol. For anyone who has a urethra tolerant to a permanent catheter as well as the time, means and patience to carry out this treatment this appears to be as safe a form of catheter life as can be devised, though the time is yet too short to say that it has fully justified itself and in any event, such scrupulous care is beyond the range of possibility for the average patient. It is much like the rich man with duodenal ulcer or gall-stones. He can carry out the rest treatment or visit Carlsbad and take the Sprudel for nine medical cures before coming to the knife, while his less fortunate brother will be obliged to consult the surgeon at once.

Only a little over twenty years ago no one had removed or attempted the surgical removal of the entire prostate. A fair number of sporadic attempts had been made to remove the obstructing portion of the gland. In the earliest surgery of the prostate the acute question arose as to the best route of surgical approach. Belfield in America, Dittel in Germany and McGill in England, succeeded in partial prostatectomies through suprapubic incisions. Ferguson, Billroth and Gouley accomplished the same result through the perineum. I well remember Dr. Agnew in a discussion upon the relative merits of the suprapubic and perineal approaches to the bladder expressing his belief picturesquely by saying that "he never

victim of enlarged prostate often came to regard his last day as the best day of his life. Factors destructive of success in the restoration of function by operation are (1) incomplete removal of the obstruction, (2) the introduction of some other source of obstruction as a sequel of the operation itself, (3) loss of voluntary control of the bladder, (4) injury to the rectum, (5) persistent urinary fistula, (6) failure to recognize and treat complicating conditions, such as vesical calculus, (7) loss of sexual or procreative power in those who are still potent.

In the hands of competent operators incomplete removal of the obstructing organ is uncommon. With the suprapubic operation it is more difficult to leave behind an offending portion of the organ than by the perineal route. The portion of the prostate which most often causes trouble is most easy of access from above and is the portion first attacked and most certain of removal. The prostate is, in the vast majority of cases, removed entire, whereas in the perineal operation morcellation is more common and the most dangerous portion of the obstruction is the deepest seated, away from the eye and more likely to escape detection. While there are some who argue that the prostate is never entirely removed and that there is always some prostatic tissue left behind in the capsule, this does not make any particular difference as long as the patient gets well. Personally, I know that in all adenomatous prostates operated by the writer that the organ has been removed entire, with all due respect to the gentlemen who argue to the contrary. Squier reports a case in which a small portion of prostate was left by perineal prostatectomy, defeating the result of the operation and requiring suprapubic removal.

Occasionally the operation in removing the prostatic obstruction introduces some other obstructive element. Stricture of the damaged urethra or vesical outlet has been known to occur. In the perineal operation stricture is more likely to occur because of the traumatism to the membranous urethra. This portion of the urethra is not touched in the suprapubic

three deaths, or a mortality of 3 per cent. Young at one time was able to report over 200 cases with a mortality of less than 3 per cent, but since then additional failures have raised the average until at the present time I believe it is fair to say that the mortality of the two operations, in the hands of their foremost exponents, is as nearly equal as it is possible to expect. Freyer was earlier in the field when the important factors of preliminary and after treatment were not so well understood as is shown by his earlier mortality of 10 per cent for the first hundred cases. The combined statistics of operators throughout the world show a greater mortality for the suprapubic operation than for the perineal. Against this we must set the fact that the suprapubic operation is undoubtedly the easier and is therefore more often chosen by the operator of less experience. Also in the case of surgeons who perform both operations the easier is more likely to be chosen in desperate cases when a minimum of anæsthesia and manipulation is desired and in cases complicated by stone, which are admittedly subject to higher mortality.

In short it is my conviction, based upon personal experience and examination of the results of others, that the mortality of the two operations *per se* is approximately equal and that the factors influencing mortality are less to be sought for in the operation itself than in extraneous conditions, the most important of which are (1) the selection of the patient, either conscious selection on the part of the surgeon or unconscious, owing to the character of his practice, (2) to the preliminary preparation of the patient for operation, (3) to the skill of the operator, and finally, to rational after-treatment.

Second only to the mortality of operation is the question of the result of operation. Indeed, so wretched may be the condition of patients of this class either without operation or after an unsuccessful or complicated operation that the result may be said at times even to outweigh the question of life or death. Before the present era of comparatively satisfactory treatment of prostatism it was remarked by some one that the

tleness in handling is thus necessary to prevent wounding the bowel. No operator of large experience in perineal work has avoided this complication. Post-operative infection or pressure necrosis also have caused the rectum to be opened secondarily even when it was left intact by the dissection. The result of such an accident at best is perineal suppuration, protracted convalescence and often a rectovesical fistula. I have injured the rectum in perineal prostatectomy but never in the suprapubic operation, except in one small carcinomatous prostate with periprostatic inflammation, a case which should not have been operated on by the suprapubic method but by the perineal, if operated at all. This is the general experience and constitutes a valid criticism of the perineal approach.

The anterior fibres of the levator ani are attached to the sides and under surface of the posterior sheath and are likely to be injured to a degree, at least, in perineal enucleation, while not so in the suprapubic. The levator ani, like the voluntary muscles of the abdominal wall, assist in emptying the bladder, consequently it is important in any operation to inflict as little injury to the surrounding tissues as possible.

The urinary fistula left after both types of operation fortunately heals very kindly in the great majority of instances. It is well known, however, that suprapubic vesical fistulæ are more likely to close spontaneously than fistulæ in the perineum. In the suprapubic operation the course of the urethra is not disturbed, while in the perineal operation it is opened in order to gain access, either with finger or instruments, to the bladder. It is inevitable that such trauma of the urethra will at times result in stricture or fistula. I cannot but feel that this sequel is not as cheerfully acknowledged as should be by the perineal operators when it has occurred to me within a comparatively short time to have observed instances of persistent perineal urinary fistulæ, loss of control of the power of urination, the patient wearing a rubber receptacle tied to the thigh, coming from the hands of a man most prominently identified with peri-

operation, but in perineal prostatectomy it is opened for the passage of the prostatic tractor in the case of Young's operation, or for the finger in the case of those who perform intra-urethral enucleation. A stricture of the lower urethra is more embarrassing to deal with than the contractions which occasionally occur in the prostatic portion, a complication to which the perineal prostatectomy is as liable as the suprapubic. In two cases of suprapubic removal I met with a complication requiring a second operation. This was obstruction of the urethral outlet by a flap of the torn mucous membrane made in the enucleation of the gland. Recovery was complete in both cases after excision of the flap of mucous membrane acting as a valve at the vesical orifice of the urethra.

Loss of voluntary control of the bladder after prostatectomy is an extreme disappointment to the patient inasmuch as it leaves his last state worse than his first. Here there is a very decided advantage in favor of the suprapubic operation. Voluntary control of the bladder is vested chiefly in the compressor urethræ muscle (external sphincter muscle), but partly in the internal sphincter (the aggregation of circular muscular fibres of the bladder at the vesical neck). It is obvious that any dissection of the perineum may occasionally inflict damage upon the compressor urethræ muscle or its innervation as well as upon the internal sphincter muscle, particularly through prolonged traction with a perineal tractor. On the other hand the compressor urethræ is in practically no danger in the suprapubic operation. The prostate lies entirely above the triangular ligament and it must be a very exceptional case or a very bungling operator that would injure the muscle, protected as it is by the triangular ligament.

The rectum is even more likely to be seriously injured than the compressor urethræ in the perineal operation. At the apex of the prostate and in relation with the membranous urethra, the rectum is held strongly forward by the recto-urethralis muscle and in some cases is almost directly applied to the urethra. The greatest care in dissection and the utmost gen-

neal prostatectomy whose writings would lead one to minimize, if not to dismiss altogether, this annoying sequel

Partial or complete loss of voluntary control is by no means unheard of after the perineal operation while after the suprapubic operation it is certainly a most unusual sequel, if it occurs at all. I have had two patients who underwent perineal removal recently consult me for this unfortunate condition

There is much less chance of failing to recognize intravesical conditions, particularly calculus, encysted stone and diverticula, with the bladder open for inspection by the suprapubic incision. Direct vision is preferable to even the most satisfactory cystoscopy. When I employ the suprapubic incision, unless the diagnosis is questionable, I rarely use a cystoscope, as I believe it is to many a marked addition to the burden of discomfort and unfavorable shock that they are called upon to endure. Exposing the interior of the bladder to the light of day dispels any mystery and reveals the truth

Much stress has been laid upon the preservation of the sexual powers by Young's method of leaving the ejaculatory ducts. In many cases it makes little or no difference whether the operation be designed for this end or not, as the sexual powers have long since waned. In the minority of cases, other things being equal, it is desirable to employ the operation which is most likely to preserve this function. The only possible attitude of mind at the present time is a judicial one, as exact data are not sufficient to determine the point. I formerly thought that I tore away the ejaculatory ducts in practically every complete suprapubic prostatectomy. Later observations have convinced me that in many cases they are left behind. Even when they are torn off the sexual appetite, erection and orgasm may be preserved though ejaculation is either abolished or occurs into the bladder. Legeve and Papin have collected from the literature exact observations on this subject in cases after suprapubic prostatectomy. They conclude that erection is conserved in the vast majority of cases and that the orgasm is ordinarily preserved. It is my opinion that the

proved for a month, or more, following the operation and then the symptoms became more marked

On admission, patient is a well-nourished, well-developed man of thirty-seven years. Has a distinct sallowness of skin and circles beneath the eyes

The patient complains of headache, of abdominal pain and also of pains and aches in almost every part of the body. Since his operation, constipation has not improved

Examination shows tenderness over the cæcum and ascending colon, especially marked in region of hepatic flexure. A bismuth radiograph of the intestines shows a marked angulation at the hepatic flexure, the first portion of the transverse colon descending parallel with the ascending colon to the neighborhood of the ileocæcal valve. Mass of bismuth still present in the cæcum and ascending colon after forty-eight hours. The X-ray photograph is shown in Fig. 2

Patient was put upon mineral oil (Russian paraffin) but did not improve. The headaches and the other pains and aches continued. He complained of distention by gas. Even the weight of his undershirt seemed a burden. A right-sided tenderness persisted, at times being marked over the entire cæcum and ascending colon, and especially at the hepatic flexure. Frequently a dilated cæcum could be easily palpated

The patient was discharged to sick leave May 28, 1913, and returned June 27, 1913, somewhat improved as to his mental condition, *i e*, the symptoms of neurasthenia were not so marked

Operation was refused, and the patient was discharged July 16, 1913, in about the same condition as when he was primarily admitted

It is evident in this case that a sharp angulation at the hepatic flexure brought about stasis in the cæcum and ascending colon and that this condition led directly to the various neurasthenia symptoms above noted. The region of the hepatic flexure could not have been explored through the small and low rectus incision

CASE III—W. B. J., landman for electrician, U. S. Navy. Admitted May 14, 1913, with the diagnosis of acute appendicitis. Gives history of constipation for seven months, of headache and backache for six months. Five months ago pain was first noticed on the right side of abdomen and has continued to date. Has never vomited. Feels dull and lazy and tires easily.

it may easily be controlled by placing a suture around the bladder margin of the prostatic bed much in the manner of a purse-string, when a small pack of gauze is placed in this bed and the suture tightened the control of hemorrhage from this source is absolute. Hemorrhage in perineal prostatectomy is not so surely controlled.

After-treatment ranks in importance with the preliminary preparation. I do not use continuous irrigation of the bladder. With a large suprapubic opening the bladder cannot fill with clots and a small amount of clotted blood if it forms makes no difference and readily comes away, while long continued irrigation is in some cases a trial to the patient and accomplishes no good. In the perineal operation I concede its necessity.

Careful nursing is essential. I always employ female nurses, as I feel that they understand better the kindly ministrations which mean so much to the comfort and morale of the patient.

The supply of water and consequent free action of the kidneys are the most important post-operative considerations. Hypodermoclysis is given during recovery from ether, and rectal saline is begun as soon as the patient is quiet. Any sign of diminution of diuresis is met by repeated hypodermoclysis. Spartein and caffeine hypodermatically are often given and seem to give good service. Digitalis and nitroglycerine may be given in cardiovascular weakness. Morphia is shunned, and sedatives in general are given sparingly and only upon the strongest indications.

In three or four days, or as soon as the strength will warrant, he is lifted out of bed into a chair and kept sitting until slight fatigue overtakes him. This should not be overdone, nor should it be omitted as it possesses great stimulating action.

In conclusion, I would summarize the advantages of the suprapubic over the perineal operations as

1. The approach to the prostate is simple and practically bloodless.

chronic cystitis is rather favorable than otherwise, inasmuch as a certain bodily resistance to infection has been generated, the local lymphatics are coffer-dammed and the consequences of post-operative infection are less serious than when operation is done in the presence of an uninfected bladder.

In the preparation of the kidneys the use of water, which is the best diuretic, is paramount. It may be given simply by mouth, or if not tolerated in sufficient quantities in this way, the use of saline by rectum or hypodermatically is sometimes efficient in greatly increasing the excretion of the kidneys. Not until satisfied as to the functional powers of the kidneys, let me repeat, should operation be done.

When the heart, kidneys and bowels are acting properly and the patient evidently in good condition operation may be attempted in the full belief that the immediate outcome will not be affected by the type of operation, provided that it be done with equal skill.

The details of the operation of suprapubic prostatectomy need not be given here. There are several factors upon which, individually, I lay stress.

The bladder is exposed by a clean incision with the knife. There is no scraping away or blunt dissection of the prevesical fat. This minimizes the danger of infection of the prevesical tissues.

The interior of the bladder and the projecting prostate may be directly inspected by the simple process of placing two lateral retractors and one in the fundus of the bladder, the mucosa of which is held by a small piece of gauze. A circular incision is made through the mucosa about the vesical orifice of the urethra. This may be done with the knife scissors or preferably the sharpened finger nail. The purpose of the complete circular incision is to avoid the complication of which I have spoken, namely, the formation of a ragged flap of vesical mucosa which may obstruct the outlet.

While the hemorrhage is rarely annoying it is at times sufficiently free to become dangerous. In the suprapubic operation

PROSTATECTOMY IN A GENERAL SURGICAL PRACTICE.

A CLINICAL REPORT *

BY HOWARD LILIENTHAL, M D,

OF NEW YORK CITY

Surgeon to Mt Sinai and Bellevue Hospitals

IN this paper is presented the experience of a general surgeon in what has come to be regarded as a special field. It contains a review of most of my work upon the prostate. Probably not more than twelve cases in all are missing and I have reported every one which I could find.

I gratefully acknowledge the kind assistance of my former House Surgeon, Dr O Baumann, in preparing most of these histories, and I am indebted to Dr F S Mandlebaum, Pathologist to Mt Sinai Hospital, for the histological work.

The surgical records at Mt Sinai Hospital from July 1, 1897, to July 1, 1898, are missing and may have contained six or seven cases. Of late years, in addition to the hospital records, I have been keeping a private file of all the patients upon whom I operate.

There are pretty satisfactory records of eighty patients, a number considerably less than I thought it would be at the beginning of this investigation. In the accompanying review every case has been reported as faithfully as possible without omission and without explaining why certain ones might have been omitted. To me this work has been most instructive and it is hoped that the thoroughly open and frank exposition of my records may help others.

In addition to the general review there are the histories of thirteen patients which I take to be of more than ordinary interest, some of them illustrating special points.

* Read before the New York Surgical Society, January 28, 1914.

2 The enucleation of adenomatous growths is accomplished with ease

3 The working field is large and under perfect control

4 The prostate is accessible and can be made more so by digital pressure on its rectal surface and without the danger of injury to the bladder from the use of tractors necessary in the perineal operation

5 The muscular control of the bladder is not disturbed, since the internal sphincter may be avoided and the compressor urethræ lies outside the line of cleavage. Incontinence is therefore less frequent following this technic

6 Permanent fistulæ are less frequent after the suprapubic operation. They never occur in fact if the urethra is bougied

7 Stones can be more easily removed

8 Sexual potency is maintained as frequently after the suprapubic operation as after the perineal, and the question of sterility is rarely of any consequence

9 The mortality is, in properly selected cases, no greater and the percentage of uncomplicated cures is larger

number of other points I may say that according to my observation the choice of methods depends on individual experience. The man who has been trained from the beginning as a genito-urinary specialist will be more apt to choose the perineal route while the one who has become familiar with the broader field of general surgery will probably select the suprapubic. To be sure there are always exceptions.

As an illustration of one of the advantages of the high operation, namely, that of clear and direct vision, I present the following unusual case.

CASE No 73 *Hypertrophy of Prostate, Carcinoma of Bladder, Two-Stage Prostatectomy, and Extirpation of Carcinoma*—J. M., eighty-six years old, had suffered for several weeks from repeated and severe hemorrhages from the bladder.

X-ray examination showed no calculus. The condition of the kidneys as well as could be judged with the large admixture of blood was sufficiently good considering the man's years. The amount of urine was ample.

For a number of years there had been frequency of urination but little pain.

The patient entered the Private Pavilion of Mt. Sinai Hospital where an attempt at cystoscopy was made, but the instrument could not be inserted. Catheter showed four ounces of residual urine.

On December 30, 1912, I performed a suprapubic cystotomy in local anæsthesia, exposing an enormous, smooth, lobulated prostate. The patient having reacted well, the second stage was undertaken in general anæsthesia on January 6, 1913, one week after the first. Enucleation was not difficult, but after the prostate had been removed I found a papilloma of considerable size in the right part of the trigonum, the tumor having been invisible until the concealing prostate lobe had been removed. The neoplasm was cut away with its base and was sent together with the prostate for histological examination.

In spite of this man's great age his arteries were in excellent condition and with the exception of some bronchitis he might well have passed as a much younger man.

He was in the hospital for 59 days and was discharged well.

General Character of the Cases—The average age of my patients was something over sixty-four years. The youngest was thirty-six, and the oldest eighty-six. Most of them were badly nourished, feeble old men with hardened arteries and diseased kidneys. A number were the victims of chronic bronchitis. Many, especially among the first operated upon, not being acquainted with the possibilities of prostatic surgery, had waited until the catheter could no longer be passed and urinary sepsis had set in. Fully 90 per cent. of these patients were poor subjects even for minor surgery and perhaps one or two of those who died did not have their days shortened by operation. In fact, one of my patients was considerate enough to succumb from the effects of a cerebral hemorrhage which occurred on the day set for operation, but before the anæsthetic had been administered, another instance which shows that we must not expect too much of statistics.

Two were diabetic. One of these died after a cystotomy, one made an uneventful recovery after a two-stage prostatectomy.

No patient who applied for relief was refused the opportunity which surgery might hold out.

Operative Procedure and Preparation—I was early convinced through the work of Eugene Fuller that the suprapubic approach was the wisest, all things considered, and I have consistently employed this method, being content to note as a mere observer the results achieved in other ways by my colleagues. I do not doubt that in certain cases perineal prostatectomy may be easier to perform than suprapubic. But my contention is that suprapubic *cystotomy* should be the first step, even though it then appears best to proceed with enucleation from below.

Without going into a discussion of details as to the advantages of the high operation, its simplicity, its freedom from untoward sequelæ, the preservation of sexual potency, the easy sight exploration of the bladder, this alone often changing the entire character of the operation, the absence of danger to the rectum—without, then, discussing these and a

CASE No 69 *Vesical Calculi Following Prostatectomy*.—E W, aged sixty-four years, was operated upon for hypertrophy of the prostate and for left hydrocele by the two-stage method, on March 31 and April 2, 1913. The first stage was cystotomy and excision of most of the sac of the hydrocele. The second stage, prostatectomy and left orchidectomy for which I had no permission at the time of the first operation. The testis was in a state of fibrosis and was obviously not functioning.

The patient made a good recovery, although I found it extremely difficult to secure acidity of the urine. He was discharged on May 18, 1913.

During the summer the patient suffered greatly with pain on urination and frequent stoppages of the stream. The urine was very foul.

In October, 1913, he returned to me for examination and with the aid of the sound I found a calculus. Confirmed by cystoscopy.

On October 28, I again opened the bladder suprapubically and removed two rather soft calculi each one the size of a small English walnut. To my surprise these stones had not formed around bits of foreign material. They were pure phosphatic calculi.

I found that the urine could be kept acid by the administration of acid sodium phosphate.

The patient went home about ten days after the lithotomy and has remained perfectly well ever since.

In the two other cases each stone had formed around a bit of tissue.

For the sake of completeness I will describe in a few words the method of procedure carried out in the cases of prostatic hypertrophy, although I would not have it understood that there is any hard and fast rule from which what I might call artistic deviation may not become necessary or advisable.

The Preparation—First. Catheterization every three to six hours according to the condition of the bladder. The more septic the urine the more frequent the catheterization.

Second. The internal administration of strophanthus or some other cardiac stimulant for the twenty-four hours pre-

I was told that later he developed epididymitis from which he promptly recovered

The report of Dr Mandlebaum on the prostate was, "Marked cystic dilatation of glandular elements, otherwise a simple fibrous hypertrophy Nothing malignant"

The bladder tumor, however, came back with the diagnosis "papillary carcinoma"

This patient has remained well up to the time of this writing more than a year after his operation The case well illustrates the common fact that a man may be full of years without being "old"

The operation demonstrated that even a cystoscopic examination would not have disclosed the presence of the malignant growth Had the perineal operation been performed the complete extirpation of the prostatic enlargement would have left a graver disease behind I can conceive of no method, except the actual removal of the prostate from above, which would have enabled us to relieve and perhaps cure this man

As a general rule in these cases I do not perform cystoscopy before operation The procedure has dangers of its own and I know I shall see the bladder clearly at the time of the operation If there is little residual urine and I suspect other than prostatic disease, cystoscopy is performed Were a low operation contemplated, however, the cystoscope even with its additional shock and danger to an old man would be absolutely essential

One post-operative use for the cystoscope I have found Before permitting the suprapubic opening to close I fill the bladder from above after having washed it as clean as possible and then insert the cystoscope through the fistula, an absolutely painless and non-shocking procedure It is easy thus to make a careful inspection for bits of slough or loose tissue which should come away lest they form nuclei for subsequent stone I have three times observed the formation of calculi following prostatectomy, twice in my own practice and once in that of another surgeon One of my cases, No 69, is here reported The record of the other I was unable to find.

Examination —Shows distinct tenderness over ascending colon, most marked over McBurney's point There is also tenderness over sigmoid but not so marked X-ray examination shows stasis, bismuth in ascending colon after twenty-four hours

Operation (June 9) —Ether anæsthesia Right rectus incision Appendix chronically inflamed and adherent to under surface of mesentery of ileum with numerous fine bands running from the tip of appendix to a point on lateral wall of ileum about two inches from its termination This condition caused acute "kinking" at this point The bands were divided Appendix removed Denuded surface covered by drawing together the peritoneum in a direction at right angles to the bowel This denuded area was mainly upon under surface of mesentery

June 20 Primary union Recovery uneventful save for considerable post-operative vomiting for first two days

July 3 Bowels move daily Pain entirely relieved Discharged July 10, 1913, bowels move daily without purgatives Headache, backache and abdominal pains have entirely disappeared

CASE IV —L O S, chief pharmacist, U S Navy Admitted May 26, 1913, with intestinal auto-intoxication

History —For the past year has had frequent and severe headache During this time there has been marked constipation with occasional mucous diarrhoea Has found it necessary to take purgatives once or twice a week on the average Chief complaint headache, also complains of malaise and lassitude On admission a fairly well nourished man of thirty-eight years, complexion clear Examination shows moderate but well-marked right-sided abdominal tenderness, most marked in the region of the hepatic flexure No history of acute attacks of abdominal pain

A radiograph of the intestines taken twenty-four hours after the administration of four ounces of bismuth oxychloride in a pint of buttermilk shows the cæcum and ascending colon loaded with bismuth Just distal to the hepatic flexure there is evidently a marked obstruction as the bismuth column terminates abruptly at this point (see Fig 3)

A second radiograph taken forty-eight hours after bismuth meal shows that peristalsis has overcome the obstruction and that practically the entire amount of bismuth is in the transverse colon

In this case there is evident obstruction and very marked

ceding operation Urinary antiseptics with salol or some other chemical which does not liberate formaldehyde

Third The patient is not put to bed

Fourth Repeated examination of the urine, chemical and microscopic

I have performed none of the supposed tests for renal function because I do not consider that any of them have been shown to be essential in surgery and because I assume that the kidneys are most probably in a more or less diseased condition and that cystotomy is fully indicated even though we know there is poor renal function The quantity of the urine, however, is noted

Fifth The day before operation the bowels are moved with castor oil

Sixth I prefer to perform these operations before noon rather than in the late afternoon so that the immediate post-operative observation shall not be at night

Seventh One hour before operation the patient receives a hypodermatic injection of morphine, the dose regulated according to his weight and general condition

The Operation—Local anæsthesia Assistant at the patient's head to talk to him and reassure him and to watch the pulse and other vital phenomena

Bladder usually emptied by catheter but if catheterization is extremely difficult I have frequently permitted the viscus to fill to its capacity and have operated with urine distention

Incision through skin and aponeurosis and then separation of muscle fibres to the space of Retzius If the catheter has been put in, the bladder may now be distended with air by means of a rubber bulb while the operator's finger feels the tenseness and general condition of the bladder wall

The peritoneum is now pushed up out of the way and held with a blunt retractor, other similar retractors holding the wound apart laterally Rarely is it necessary to tie or clamp a vessel up to this point

The patient should be informed that air is to be injected so that he may be prepared for the sensation

The prostate enucleated in one or more pieces according to the planes of cleavage

The prostate is often much smaller and far less vascular eight or nine days after the cystotomy than it was at the first operation and bleeding is therefore minimized

The prostate having been removed the bladder is flushed with water at about one hundred and ten degrees Fahrenheit, then emptied and drained by tube as after the first operation. If hemorrhage has been profuse I place a packing of gauze upon the mucosa which has now fallen into the hollow from which the gland was removed

Patient sent back to bed with sand bag upon the abdomen for from twelve to twenty-four hours

In forty-eight hours the gauze packing is removed and the man is urged to leave the bed and pass part of the day in a chair

The bladder should be irrigated once a day at least through the tube

The testicles must be supported

Whether it is possible to avoid epididymitis by vasectomy I am unable to say. I have practised this method in one of the cases here reported (No 79, December 30, 1910). Benedetto Cinno (*Zentralblatt für Chirurgie*, 1931, No 42, page 1644) is quoted as having adopted this method at the time of the primary cystotomy

I have occasionally noted that after the first week following the prostatectomy an occasional rise of temperature has been explained when rectal examination disclosed retention in the prostatic pocket. This may be emptied by massage once or twice a day and in none of my cases has it caused more than mere annoyance to the operator

But this is not the place for complete discussion of the subject of convalescence. A detailed work on the management of these cases might well make a volume of considerable size

A word concerning air inflation of the bladder. Lastaria is quoted in the *Zentralblatt für Chirurgie* (1913, No 42, page 1645) as favoring cystotomy with the bladder absolutely

Two traction-sutures are passed through the entire thickness of the bladder wall in its upper presenting part and while these draw the viscus toward the surface the wall is incised by knife-puncture. The opening in the bladder high up facilitates the subsequent closure of the fistula as suggested by Squier. The puncture wound made by the knife is now dilated with dressing forceps and the bladder explored, first by touch, then by sight with the aid of retractors, the patient being placed in a modified Trendelenburg's posture. The holding-sutures on each side of the wound in the bladder are now made fast to the aponeurosis so as to prevent the viscus from falling away from the anterior abdominal wall, exposing too freely the space of Retzius. A large tube is put into the bladder and the external wound is packed with gauze.

The patient is put to bed for the day but as a rule he is made to sit up out of bed the following day if only for a short time. The nurse is instructed to see that frequent deep inspirations are taken. In two or three days he is encouraged to walk, the abdomen being confined by a snug binder. Not until the patient is better than before the operation, both subjectively and objectively, is the second stage undertaken. This period in my list of two-stage cases averaged between eight and nine days.

Second Stage—Operating table slightly elevated below. Patient prepared for general anæsthesia. Nitrous oxide, nitrous oxide and oxygen, ether, chloroform or one of their combinations or sequences is now given to the point of relaxation.

Digital divulsion of the wound

No instrument in the urethra

Bladder thoroughly washed out from above

The gloved finger of an assistant in the rectum to push up the prostate

Closed, sharp pointed scissors plunged into the prostatic substance at the internal urethral opening or, if the ungloved hand of the operator is being employed, this opening into the prostate may be made with the fingers

out of the forty died, or 22.5 per cent. The first two cases in this list were not, properly speaking, prostatectomies at all. In one a part of the gland was removed with the *écraseur*, in the other the Paquelin cautery was used. Both died. This would leave 38 prostatectomies proper, with 7 deaths or 18.42 per cent.

The thirty-one patients who were discharged from the hospital spent an average of 35.48 days from the time of the operation to discharge.

There were thirty-three cases exclusive of carcinoma in which prostatic enucleation in two stages was performed. Their ages averaged about the same as the single-stage ones, 64.33 years.

Of these two died or 6.06 per cent. The thirty-one others spent an average of 41.62 days in the hospital—about six weeks. This is 6.14 days more than the average of the single-stage cases. But the average number of days between the first and second stages of the thirty-one discharged patients was 8.7, therefore, two and a half days of this time was, as it were, made up. While this is not a particularly important matter it certainly appears to show that the added operation has no tendency in itself to prolong convalescence.

Among the eighty patients there were seven cases of carcinoma of the prostate or 8.75 per cent. Since, among my earlier patients, only the suspected specimens were examined there might have been cases of carcinoma which were not diagnosed. Of these seven acknowledged cases, however, the average age being about 66 years, two were operated upon by the single-stage method and both died. Five by the two-stage method and four recovered. Two patients showed metastases in the upper part of the femur. The pre-operative histories of these cases of carcinoma were about the same as those of hypertrophy. On examination the stony hardness of the rectal mass would arouse suspicion and at operation the induration of the tumor and the absence of the customary cleavage planes have more than once called my attention to the malignant character of the disease.

empty. There is no objection to this except that it is slightly more difficult, and in local anæsthesia the speed of the operation is of importance. I have repeatedly opened the bladder on a steel sound of large size put in through the urethra and made to present above the pubes after the incision down to the space of Retzius had been made. Lastaria reports a mishap which is supposed to have occurred to another surgeon, Marion, who lost a patient from air embolism after nine hundred cubic centimetres of air had been used to distend the bladder. It was said that at the post-mortem examination the heart was opened under water and that five hundred cubic centimetres of air escaped! It appears remarkable that in the short period of air distention more than half of the air should have entered a vein and reached the heart. It seems also remarkable that the right heart should have been able to hold a pint of air which after death would not escape into the vessels. The report is most unconvincing. I recollect a number of years ago, two German observers reported an experiment in which air had been injected into a dog's bladder. This air was said to have passed up through the ureter, to have reached the kidney pelvis, to have passed in some way through the kidney parenchyma into the renal veins and then to the heart, causing death! I recollect also that not long afterward some other observer failed to verify these observations in a repetition of the experiment.

Certainly, in the conscious human being moderate insufflation of the bladder is usually accompanied by the escape of much of the air alongside the catheter and it is necessary to continue blowing in order to gain sufficient distention for our purpose. Also, it will be noted that no air is pumped in until the finger of the operator is upon the bladder in the space of Retzius. The penis is never ligated to prevent the escape of any excess of air.

A Review of the Tables—There were forty patients upon whom operations upon the prostate were performed in one stage for non-malignant disease. The age of one of these patients is not given but the others average 64.74 years. Nine

On cystoscopy I found a mass, smooth in outline, just to the left of the median line of the prostate on the posterior wall

On May 10, 1905, I operated, placing the patient in Trendelenburg's posture and exposing clearly to the eye the little tumor I removed it easily by enucleation Nineteen days afterward a left suppurative epididymo-orchitis set in, so severe in character that on June 3, only four days after the onset, I performed orchidectomy He then made a prompt and permanent recovery All his symptoms were relieved

Examination of the tumor showed it to be an adenoma

The testis was honeycombed with abscesses

This case is of further interest because the patient was able to empty his bladder completely before operation

The next complication was that of hemorrhage of which there were five cases

One a slow continued hemorrhage which was finally checked by cauterization

CASE No 52 *Continuous Hemorrhage Following Prostatectomy in Two Stages, Cauterization of Bleeding Point*—The patient, W E S, fifty-eight years old, was operated upon by the two-stage method, the prostatectomy having been performed on November 29, 1907 After the second operation the bleeding never entirely ceased and although Mr S was up and about with good appetite he became progressively more anæmic until about two weeks after the operation I was forced to intervene

In general anæsthesia I dilated the suprapubic wound with the patient in Trendelenburg's posture and easily exposed a minute bleeding vein in the mucosa, there being no hemorrhage from the intravesical prostatic wound itself The bleeding point was touched with the actual cautery and the patient made a rapid and complete recovery

Pneumonia occurred three times and one of the patients died

Three patients had uræmia and all died

Three patients died after cystotomy without an operation upon the prostate On careful consideration I have counted these with the one-stage cases While they were not actually

All the cases reported here were of the intracapsular non-ulcerating variety. None showed subsequent carcinoma of the suprapubic scar, although I have seen this unfortunate sequel in a case of squamous celled carcinoma of the bladder without prostatic involvement, and it is a well-known phenomenon for papillomata of the bladder to be thus transplanted. It appears to me that the adenocarcinoma which comes as a degenerative focus in a case of adenomatous hypertrophy is not a very malignant form of cancer. Cases 76 and 79 indicate this.

Vesical calculi were found in thirteen cases or 16.25 per cent. It is my observation that in multiple bladder stones or single calculus of great size the postprostatic pouch is apparently deepened by the weight. Simple lithotomy may then be followed by a vesical fistula which will not close without prostatectomy.

In Case No. 44 I performed suprapubic lithotomy, removing twelve large stones which aggregated 120 grammes in weight. The prostate was but slightly enlarged and its elimination was not contemplated. Thirty-two days after the lithotomy, however, although the patient was urinating through the natural passages most of the urine came by way of the fistula. Therefore, I operated again, enucleating the small adenomatous prostate. Recovery was prompt and complete, the patient remaining well until the present time.

Post-operative Complications—The most frequent condition was epididymitis which occurred seven times. Once the testicle became acutely septic and had to be removed. The other six were what might be called surgical aggravations.

CASE No. 26 *Adenoma of Prostate, no Residual Urine, Suprapubic Prostatectomy*—S. T., aged forty-seven years, complained of increasing frequency of urination. He had consulted a number of surgeons but because he completely emptied his bladder and because the prostate was very small by rectum operation had not been suggested. There was no bleeding, no loss of weight.

came for treatment, no matter how bad the condition, was operated upon This is not a series of selected cases

With the two-stage work and its 6 per cent. of mortality I can find little fault The two patients who died could probably not have been saved by any other method while some whose cases looked most desperate made good recoveries (For example, case of M H, No 60, here reported)

It is quite probable that increasing skill and experience in the care of these patients both before and after operation may be elements which have a bearing on the improvement of statistics after the adoption of the two-stage operation Still, the change was of too sudden a nature to be thus accounted for Also, the loss of a one-stage patient, Case No 35, after the general adoption of the two-stage principle, and the death of three patients after simple cystotomy form arguments against this theory.

Statistics must be taken for what they are worth Had I written this paper one year ago there would have been no death rate from the two-stage suprapubic prostatectomy

CASE No 8 *Post-operative Hypogastric Hernia*—J R This patient, sixty-one years old, was admitted to Mt Sinai Hospital on May 16, 1901, with a suprapubic sinus of small size from a previous cystostomy This was in the early days of radical prostatic surgery and at the time of his first operation the surgeon who operated was not prepared to perform prostatectomy

The patient had much pus and blood in his urine and there was a massive suprapubic cicatrix with a pelvic exudate pericystic in character

On May 25, in nitrous oxide and ether anæsthesia I excised the sinus and removed a large fibromatous prostatic mass The wound was healed and the patient discharged on August 17, fifty-one days after the operation The pelvic exudate had not yet, however, absorbed

I followed this case for a number of years and it is the only one in which I ever saw a suprapubic hernia develop This hernia had no neck but was a general bulging of the entire hypogastric abdominal wall It was easily retained by a binder

CASE No 15 *Spinal Syphilis, Previous Bottini's Operation,*

cases of prostatectomy the complete operation was certainly contemplated, and I think there can be but little doubt that had these patients been subjected to the major procedure at the original operation they would have died just as they did after the minor one

Among the more unusual forms of prostatic obstruction I report here a case of aberrant prostate. This patient was since my own boyhood my intimate friend and I can corroborate, from personal observation, the interesting facts of the early history

CASE No 33 *Aberrant Prostate, Suprapubic Extirpation*—F. W. L., forty-six years old, had always noted that it took him a very long time to empty his bladder and that the stream was not as forcible as he considered normal. Actual dysuria began about his forty-fourth year when there was occasional retention with the necessity for catheterization. After one of these attacks there was severe cystitis with urinary sepsis.

On March 15, 1907, I performed suprapubic cystotomy. I found an enormous bladder not greatly trabeculated, a large but apparently not diseased prostate, and to the left side and near the floor of the urethra there was a mass the size of a buck-shot, which I removed, cauterizing the base.

Thirty-five days later he left the hospital entirely well and has remained so up to the present time.

Dr. Mandlebaum reported on the histology with the diagnosis of "aberrant prostate." I think there is little doubt that the childhood symptoms of this patient may be ascribed to this peculiar anomaly.

It is to be regretted that pathological examinations were seldom made in my earlier cases.

Besides the review, which speaks for itself, there is little more to say. With the exception of the case of leukemia here reported (Case 71) and those of carcinoma I am well satisfied with the apparently perfect restoration of function of all the patients who made operative recoveries. My early mortality statistics in the one-stage operation are not brilliant, but again I call attention to the fact that every patient who

was a deaf mute and was unable to read or write and indicated by signs that he had pain in the urethra on urination

The X-ray showed vesical calculi. The general health of the man was good and on April 8, 1912, I performed a suprapubic cystotomy in general anæsthesia. Four calculi were removed and on exposing the bladder the mucosa was found tensely injected. There was a deep retroprostatic pouch and the prostate itself, though distinctly enlarged and of such form as to cause a barrier to urination, was probably not the sole cause of the distressing symptoms. Enucleation in three pieces. The bladder was much hypertrophied and of a rather abnormal shape, being considerably elongated but not widened. It had evidently been in a state of chronic spasm so that it held practically no fluid when the patient was not anæsthetized.

The reason for breaking my rule and performing this prostatectomy at one sitting was because of the difficulty in making the patient understand. His condition also was so good that the added risk did not appear to be great.

The histology of the specimen which was removed was "adenoma, hypertrophy of the ducts, perifollicular inflammation."

A number of days after the suprapubic wound had healed it broke down again following an attack of retention probably due to the presence of a loose slough which interfered with urination. The wound closed and thirty-four days after operation the patient was discharged from the hospital urinating normally.

CASE No 36 *Adenomatous Hypertrophy of the Prostate With Acute Inflammation, Prostatectomy*—J L, thirty-six years of age, was operated upon on December 25, 1907. There had been repeated attacks of urethritis and distinct prostatism.

The past history of the patient was one of sexual excess. For more than a year there had been dysuria with incomplete emptying of the bladder. By rectum there was a large, soft, rather tender prostate.

At the operation characteristic hypertrophy of the prostate was found and the mass enucleated. It was 30 grammes in weight and honeycombed with purulent foci.

Histology reported by Dr Mandlebaum as "adenomatous hypertrophy with acute inflammation."

Single-Stage Suprapubic Prostatectomy—Nathan M, aged sixty-four years, was admitted to Mt Sinai Hospital on July 14, 1902. He was suffering from advanced spinal syphilis of the tabetic type. For some years he had had bladder symptoms with retention and overflow, the so-called residual urine amounting to about 16 ounces. More than a year before his admission to Mt Sinai he had been operated upon by the Bottini cauterization method but without relief and an authoritative neurological opinion was that the vesical retention was caused by his spinal lesion.

Cystoscopic diagnosis was not so accurate in those days as it is now, but by the more usual general examination I concluded that a suprapubic exploration was justified.

Accordingly, on July 15, 1902, I opened the bladder under gas and ether anæsthesia followed by chloroform. It was at once evident that a considerable hypertrophy of the prostate existed and that a pedunculate middle lobe had been divided sagittally by the Bottini's cautery. The two parts had not fused in healing but fell together in such a manner that they effectually blocked the urethra. Prostatectomy in the usual manner was performed and 34 days later the patient left the hospital well.

He remained in perfect health so far as his urinary apparatus was concerned and died only a year ago.

CASE No 35 *Prostatic Hypertrophy With Retention and Overflow, Myocarditis, One-Stage Suprapubic Prostatectomy Death*—N N, aged seventy-one years, after two years of bladder symptoms had an attack of retention and overflow which continued for about a week before a catheter was passed.

I strongly advised cystotomy then prostatectomy but the patient and his friends were most urgent in their desire for a one-stage operation and most unfortunately I acceded.

On April 22, 1907, I operated opening the bladder suprapubically under local anæsthesia then continuing with ether. There was little bleeding and no cause for shock but the patient went to pieces and died a cardiac death in about twenty-four hours.

Post-mortem examination showed grave disease of the coronary arteries. The prostate was the seat of adenomatous hypertrophy.

CASE No 39 *Vesical Calculi, Enlarged Prostate; Deaf Mutism, One Stage Prostatectomy*—J S, aged forty-two years, was admitted to Mt Sinai Hospital on April 2, 1912. The patient

In four weeks he was well and he has remained well. Virility and urination normal.

CASE No. 40 *Suprapubic Cystotomy, Death*—This case is one of a man seventy-three years of age, M. R., who was admitted to Mt. Sinai Hospital on January 12, 1913. He had retention with overflow. The urine contained a large amount of albumin, red blood cells and many white cells.

On January 13, 1913, under local anæsthesia I opened his bladder for drainage, intending to perform prostatectomy at another time. His condition after the operation was good, but in twenty-four hours he became noisy, delirious and uræmic, with fatal issue.

CASE No. 60 *Enormous Vesical Calculus, Hypertrophy of Prostate, Myocarditis, Glaucoma, Two-State Prostatectomy*—This patient, M. H., had had 15 years of dysuria. He had been examined by many physicians and surgeons. When I saw him in October, 1910, there was constant vesical tenesmus and after urination only a few drops of what was thought to be "residual" was obtained by catheter. I immediately advised radiography which the man put off for two months longer. He then entered Mt. Sinai Hospital in a dreadful condition with urinary sepsis, a miserably acting heart and almost blind on account of his glaucoma.

Radiography showed a shadow of great size far above the pubic region. Cystoscopy caused severe hemorrhage so I had to desist, but the searcher immediately felt the stone. I at once opened the bladder and removed a calculus which when perfectly dry weighed 3 ounces. The bladder wall hugged the calculus closely, the high position of the stone being explained when I discovered a prostate so large that the stone, as it were, on top of it was far above the pubes.

A week after the lithotomy, in chloroform anæsthesia by Doctor Bennett, I enucleated a prostate the size of a large lemon. Recovery was perfect with the customary great improvement in general health.

This man I considered to have been what I might call the worst surgical risk of my entire experience.

CASE No. 71 *Suprapubic Prostatectomy in a Leukæmic Patient*—The following history is of interest principally because of the unusual complication of leukæmia. In this fatal disease

stasis, as the tail of the bismuth column has not passed the hepatic flexure at the end of forty-eight hours

CASE V—A L M, seaman, U S Navy Admitted January 4, 1913, with deformity of nose Deformity corrected March 11, 1913.

Readmitted June 11, 1913, with intestinal auto-intoxication History of constipation, abdominal pain, slight malaise, lassitude and frontal headache for one year and a half The pain was always referred to the right side of abdomen Is able to do his work but does it with great effort

Examination—Well-developed, fairly well-nourished man of twenty-four years Marked tenderness over McBurney's point and slight tenderness over entire ascending colon.

Operation (June 16, 1913)—Ether anæsthesia Right rectus incision Appendix chronically inflamed, removed Cæcum extremely movable, can be carried across midline Extending from the hepatic flexure to the parietal peritoneum in a direction upward and outward there is a well-marked Jackson's membrane producing a definite angulation at this point This membrane is divided transversely and the denuded area covered by bringing together the peritoneum in the direction of the long axis of the membrane with a continuous Pagenstecher The mobile cæcum is fastened to the posterolateral wall of the abdomen by two sutures of the same material

June 24, 1913 Recovery uneventful save for moderate greenish vomiting for first two days

June 30, 1913 Recovery uninterrupted

July 3, 1913 Abdominal pain entirely relieved Feels better in every way

July 25, 1913 Discharged to duty Feels entirely well Bowels moving regularly

CASE VI—R H J, past assistant paymaster, U. S Navy, age thirty-three years

The following entries are from the health record of this patient:

"U S Naval Hospital, Washington, D C, March 21, 1913 Admitted with history of severe abdominal pain followed by gaseous distention about March 5 Was very much prostrated at the time Attack passed away with passage of flatus Last night was seized with diarrhœa and passed a small amount of clotted blood, no tenesmus"

After their removal the suppuration ceased and wounds closed by perfect healthy granulation.

Examples like this explain why surgical operations for these chronic suppurating sinuses often fail. A glance at the radiograph which represents injected sinuses teaches us how irrational it is to attempt a dissection of a net-work of sinuses which lead into an inaccessible region. In the light of these pictures the probing of a sinus will not appeal to those who wish to be consistent (see Fig. 4).

I have previously cited a large series of cases in which incorrect diagnosis of the sinus led to useless and even dangerous surgery, in which, aside from the therapeutic results, the paste cleared up the cause of failure. (I cite here only one surgical-example.)



ed rectal fistula, repeatedly operated causing incon-
disclosed to be tuberculosis of the eleventh dorsal

A. H., fifty years old, was first seen by me in June, 1913. He stated that four years before he had been treated for pararectal abscess, after he had suffered for nearly eight years with what was thought to be rheumatism of the back. The operation resulted in a fistula, fever and emaciation began from that time. He was confined to his bed **nearly** all the time. A second and third operation was performed with division of the sphincter resulting in complete incontinence of the rectum. Another operation was then performed above the crest of the ileum and two more sinuses remained. I saw him in June, 1913, at his home in Canada. He was unable to walk, having been confined to bed for the last fourteen months. July 12, 1913, he was brought to Chicago. The injection of paste as shown in Fig. 5 revealed the true diagnosis. The sinuses with several side tracks reached from the rectum directly into the eleventh and twelfth dorsal vertebræ, where the disease originated. The injection not only cleared up the diagnosis but had a marked therapeutic effect. The rectal sinus closed, and the man gained twenty pounds in six weeks, and was able to walk about five miles each day. He is now engaged in his usual work, but the two sinuses at the crest of the ilium still discharge small quantities of pus.

one would naturally make every effort to avoid a capital surgical operation on account of the well-known hemorrhagic tendency

In this case, however, the vesical condition had become so threatening that something had to be done. Fortunately there was an operative recovery.

G S, aged seventy-two, had suffered for some years with the usual symptoms of prostatic obstruction and had been catheterizing himself with a woven instrument for one year

In August, 1913, he had been operated upon for a left strangulated inguinal hernia and for the three following weeks he had evidently suffered from vesical distention with overflow, no catheter having been passed during that time

At his own suggestion his physician catheterized him and withdrew then a large quantity of urine containing much foul pus

On September 20, 1913, he came to New York where he entered Miss Maluk's private hospital

I found a feeble, pale, emaciated man. The temperature, however, was normal and the pulse 80, showing some hypertension. Twenty-three ounces of extremely foul urine were withdrawn by catheter the last part of which was almost pure pus. Frequent catheterization and irrigation improved him and on September 24, 1913, I performed suprapubic cystotomy preliminary to a contemplated prostatectomy. At this time there were fifteen ounces of residual urine. By rectum there was a large soft prostate. The spleen was very large and hard, extending beyond the median line and far below the umbilicus. The patient stated that he had had malaria and that a physician had told him twelve years before that he had an enlarged spleen. The lymph-nodes in the various parts of the body were not enlarged and at this time no blood examination was made.

A week later, in gas and ether anæsthesia, a prostate three ounces in weight was enucleated. The lobe on the anterior wall was very large and fleshy.

Thirty-seven days after the first operation he was discharged urinating normally and apparently in excellent general condition. Within the next few weeks he gained 16 pounds in weight and I dismissed the case from my mind. Then, however, he began to have pain in the region of the old hernia wound and an induration with slight reddening of the skin appeared there. Although the temperature remained normal I thought that probably a deep,

No	Name	Age	Date of Operation	Preoperative Complications	Anesthetic	
1	H M	63	Nov 13, 1896	Vesical calculi, hemorrhagic cystitis	Chloroform and ether	
2	K R	56	June 27, 1900	Chronic sepsis, emphysema	N O and ether	
3	I L	74	Sept 25, 1900	Previous castration, catheter life 22 years, urinary sepsis	Chloroform	
4	M G	58	May 28, 1901	Retention	N O and ether	
5	J R	58	July 4, 1901	Attacks of retention	N O and ether	
6	J H C	56	June 25, 1901	Laceration of urethra, false passage, hemorrhage	Chloroform	
7	S L	63	May 11, 1901	Bronchitis, myocystitis, much pus in urine	Eucaine 6 per cent	
8	J R	61	May 25, 1901	Suprapubic vesical fistula from previous operation	N O and ether	
9	A T	75	Feb 7, 1902	Nephritis, poor condition, vesical stone	Chloroform	
10	B W	65	Feb 12, 1902	Nephritis, retention	Chloroform and ether	
11	S G	53	Feb 8, 1902	Retention	N O and ether	
12	A L	80	May 13, 1902	Retention	N O and ether	
13	H K	71	June 20, 1902	Catheter life	Chloroform	
14	J L	64	June 28, 1902		N O and ether	
15	N M	64	July 15, 1902	Spinal syphilis, residual urine 16 oz	N O and ether and chloroform	
16	R L	75	Nov 24, 1902	Diabetes, vesical calculi and hematuria, 10 years	Chloroform	
17	J S	77	Jan 4, 1903	Vesical calculi, nephritis, bad condition, edema of feet and legs	N O and ether	
18	R G	70	Nov 24, 1903		N O and ether	
19	H J	?	Dec 26, 1903		N O and ether	
20	L M	68	Jan 23, 1904	Retention and overflow	N O and ether	
21	J L	49	April 25, 1904	Retention, neurasthenia	N O	
22	T A	60	May 13, 1904	Cystitis, cicatrix of former transverse suprapubic cystotomy, retention and catheter life	N O and ether	
23	B B	77	Feb 14, 1905	Nothing remarkable	N O and ether	
24	L F	68	May 3, 1905	Nothing unusual	N O and ether	
25	S M	55	Nov 18, 1904	Vesical calculi	N O and ether	
26	S T	47	May 10, 1905	Years of dysuria	N O and ether	
27	J B	69	May 20, 1905	Nothing of note	N O and ether	
28	A P	70	Nov 24, 1905		N O and ether	
29	S L	70	Jan 9, 1906		Chloroform	
30	S S	80	Jan 24, 1906	Nocturnal frequency, for ten years, recent severe hematuria after catheter	Chloroform	
31	H H	52	June 12, 1906		N O and ether	
32	M O	69	Feb 26, 1907	120 cc residual but great prostration, some hematuria	N O and ether	
33	F W L	46	Mar 15, 1907	Symptoms many years, cystitis following cat catheter	N O and ether	
34	S H	37	Apr 2, 1907	75 cc residual clear urine, nervous irritability	N O and ether	
35	N N	71	Apr 22, 1907	Passed 25 cc at a time (6 or 7 p.m.), patient in poor condition, myocystitis	N O and ether	
36	J L	36	Sept 25, 1907	Repeated urinary retention, even and strict prostration	N O and ether	
37	L H	59	Jan 22, 1909		N O and ether	
38	A L	44	May 23, 1910	Vesical calculi	N O and ether	
39	J S	42	Apr 8, 1912	Vesical calculi	N O and ether	
40	M R	73	Jan 13, 1913	Retention of urine	N O and ether	

between the two operations During this time the patient was repeatedly examined and had gained so much in strength that he was walking about like a well man The result was naturally most disappointing

It appears to me that hiccough is in these cases a symptom pointing to renal or cardiorenal insufficiency

NOTE—After the meeting one of my colleagues privately expressed the opinion that the three fatal cystotomies should have been counted among the two-stage cases of prostatectomy On arguing the matter with a number of others, I have come to the conclusion that these three cases should in truth not be counted at all, since they were not operations upon the prostate In the anteprostatectomy days suprapubic cystotomy was common as a relief measure—and this operation had a very considerable mortality

For the sake of completing the statistics then there may be counted 37 cases of one-stage operations upon the prostate—not 40—with 16.21 per cent mortality The mere matter of intention cannot change the fact that no prostatic operation was done

TABLE OF MORTALITY

Case No	Cause of Death	One-stage	Two-stage	Number of Days after last Operation
2	Uræmia ("gradual deterioration")	I		10
10	Uræmia	I		6
40	Uræmia	I		5
1	Shock (hemorrhage)	I		1
74	Shock (hemorrhage), carcinoma	I		5
7	Shock	I		1
75	Shock (carcinoma)	I		1
28	"Collapse," no hemorrhage	I		2
30	Cardiorenal	I		3
72	Cardiorenal		I	8
35	Cardiac	I		1
16	Coma (diabetic)	I		4
70	Pneumonia		I	3
78	Gradual deterioration (carcinoma)		I	50

Fig. 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 38. 39. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 61. 62. 63. 64. 65. 66. 67. 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 79. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 99. 100.



Fig. 1

tionship of the diverticulum and ureter so that the ureter would not be injured in removing the pouch. This, however, could not be satisfactorily accomplished from within the bladder and with the wall of the left side of the bladder held firmly by an assistant, dissection was carried down to the base of the bladder, exposing and freeing the ureter for 2 or 3 inches. The ureter was held to one side while the diverticulum was separated from the surrounding fatty tissue and removed. The opening in the bladder was closed with the ureter in sight so that it could not be injured or its lumen interfered with. Two small rubber tissue drains were left down in the space at the side of the bladder where the diverticulum had been. These drains were removed on the third and fourth days. There had been no drainage of urine, just a little serum. The entire wound healed practically by primary intention and the patient was up and around in ten days and made a complete recovery. A letter from him two months after the operation states that he is well.

In the second and third cases, the operation was performed for stones in the lower ureter. In the second case a small stone was firmly lodged in the lower end of the right ureter. The Rontgenogram and the cystoscopic examinations confirmed the diagnosis. The patient, a female, aged thirty-one years, had been having repeated typical attacks of colic.

Operation—The ureter was exposed as in the preceding case with the diverticulum, except that the bladder was not opened. As soon as the peritoneum had been reflected from the bladder for a little distance the right side of the bladder was retracted toward the midline and held firmly. After a very little dissection through the fat toward the base of the bladder, the stone could readily be felt. Before manipulating the stone the ureter was freed for an inch and a half or two inches above the bladder and a pair of tacking forceps were clasped across the ureter. This was done to prevent the stone from slipping up the ureter in case it became dislodged. The stone was then grasped between the fingers and removed through a small longitudinal incision in the ureter. No attempt was made to suture the opening. A rubber tissue drain was inserted and removed on the fifth day. There was

Admitted to the U S Naval Hospital, New York, June 29, 1913 Gives history of prolonged tropical duty and of mental strain and worry About sixteen months ago had an attack characterized by abdominal pain, vomiting, dizziness and looseness of bowels Since this time has had five or six similar attacks During one of these attacks blood and mucus were passed Bowels always regular Complains of malaise, of lassitude and abdominal discomfort and occasional abdominal pain This pain is not localized but there is marked local tenderness below the ribs at the hepatic flexure Is markedly neurasthenic, dwells much upon his troubles, mental and physical Is well nourished but is decidedly sallow, complexion muddy and there are dark rings under the eyes.

X-ray examination of intestines after bismuth meal shows very marked stasis The bismuth begins to pass the hepatic flexure only after thirty-six hours At this period the ascending colon is distended with bismuth and there is marked angulation at the hepatic flexure (see Fig 4) The patient's history and physical condition with the X-ray findings making an almost positive diagnosis of chronic intestinal intoxication from stasis which is probably caused by Jackson's membrane at the hepatic flexure

Discharged to duty June 30, 1913 Relief of condition by operation suggested but declined This patient's condition has improved upon a vegetable diet and purgatives

CASE VII—J W E, chief gunner's mate, U S Navy Admitted July 19, 1913

A well-nourished man of thirty years Has been chronically constipated for past three or four years About one year ago had sharp attack of abdominal pain, confined to right iliac region, lasting only for a minute or two, no nausea or vomiting Felt dizzy About six months ago had a second attack, similar to the first, but more severe, lasting two or three minutes, no nausea or vomiting

Third attack, three weeks ago, lasting for three days with remissions During this time vomited frequently, whenever food was taken Pain confined to right iliac region

Examination—Shows tenderness quite marked and strictly localized to a small area below and internal to McBurney's point

Operation (August 20, 1913)—Ether Right rectus incision Two typical Lane's kinks were found, one about three inches and the second six inches from the ileocæcal valve The band produc-

FIG 2



Shows same incision with the peritoneum and fat dissected off The bladder is held to one side by soft forceps which do not grasp the muscular wall of bladder

RECTOVESICAL ECHINOCOCCUS CYST.*

BY J BENTLEY SQUIER, M.D.,

OF NEW YORK,

Director of Genito-Urinary Department, New York Post-Graduate Hospital

THE usual sites of implantation and growth of echinococcus disease have long been noted and the surgical indications satisfactorily worked out. It is only when the disease presents bizarre features that it assumes importance of sufficient interest to warrant a record of the case. On such grounds the case about to be detailed seems qualified for publication.

An Italian, thirty-five years of age, was brought to me by his physician, on September 21, 1913, with the diagnosis of an enormous vesical calculus. The diagnosis had been arrived at after radiograph examination. The patient was greatly emaciated and his chief complaint was frequent urination and intense pain in the glans penis. The abdomen was distended by a tumor occupying the hypogastrium, whose upper limit was midway between the ensiform and navel. Percussion and palpation of the tumor indicated it to be a greatly distended bladder. Rectal examination showed a marked bulging of the tumor in this situation, compressing the rectum. Bimanually the tumor felt cystic, a soft rubber catheter passed to the bladder without obstruction, and six ounces of clear urine was obtained.

Cystoscopic examination was impossible, the reason of which will be shortly appreciated. The previous history of the patient did not add much. He had been losing weight and strength for months, the abdomen had been steadily increasing in size and the above mentioned vesical symptoms in severity.

The radiograph submitted by his physician showed at a glance that a faulty interpretation of the findings had been made.

The shadow mistaken for a calculus being outside the bladder area, cystotomy was decided upon and accomplished under a

* Presented before the New York Academy of Medicine, Genito-Urinary Section, November 19, 1913

little, if any, leakage of urine and the patient made a satisfactory convalescence.

In the third case, in addition to the attacks of colic due to the stone in the ureter, which was shown also by both Rontgen and cystoscopic examinations, there was also conclusive evidence of previous and recent attacks of appendicitis. In this case the patient was a male, aged twenty-seven years.

Operation —As in the previous cases, the incision was made in the midline between the recti muscles. In this instance, however, it was continued through the peritoneum, and the appendix, which was subacutely inflamed, was removed. The stone in the right ureter about 4 inches from the bladder could readily be located by exploring from within the peritoneal cavity. After the appendix was removed, the opening in the peritoneum was closed and protected by gauze pads. The ureter was exposed as in the previous cases and a stone about a half inch long and a third of an inch in diameter was removed. The usual rubber tissue drains were left in the wound for several days. In this case there was drainage of some urine through the wound at first but the wound was entirely closed within ten days.

Besides these two cases of stone in the ureter and the one of diverticulum of the bladder, the method has been used to expose the ureter in three cases of extraperitoneal resection of the bladder for cancer. In these three cases the resections were for the removal of a considerable portion of the bladder which contains one of the ureteral openings, and it was necessary to expose the ureters at this point outside of the bladder in order to transplant them satisfactorily.

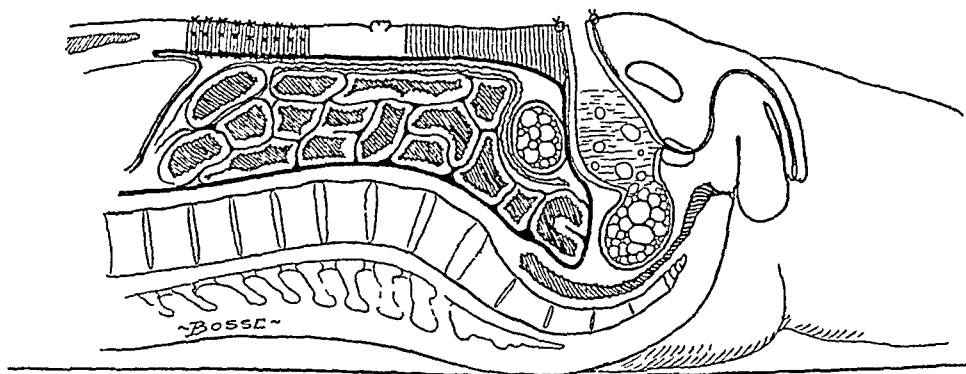
With our limited experience, thus far this technic seems to have some advantage over the other methods, especially for the removal of stone. The search for the ureter may be quite tedious, though if it contains a stone, as in our two cases, it can be located by using the stone as a guide. In the female the uterine artery will usually be exposed, in the male, the seminal vesicle may at first be taken for the ureter though the difference will soon be discovered.

proved from the start. The evacuation of the cyst-filled bladder caused disappearance of the main tumor, and made possible further examination of the abdomen by palpation. Such examination revealed a tumor mass, situated in the region of the right epigastrium.

As speculation had been rife as to the manner the echinococcal disease had invaded the man's bladder, the finding of this mass offered a possible explanation, namely, that the disease was primary in the kidney and the bladder had been involved by cysts passing down the ureter. More careful examination of this right-sided mass, however, made one suspicious that it might as well be connected with the liver as the kidney.

Ten days after the cystotomy the right kidney was explored

FIG 3



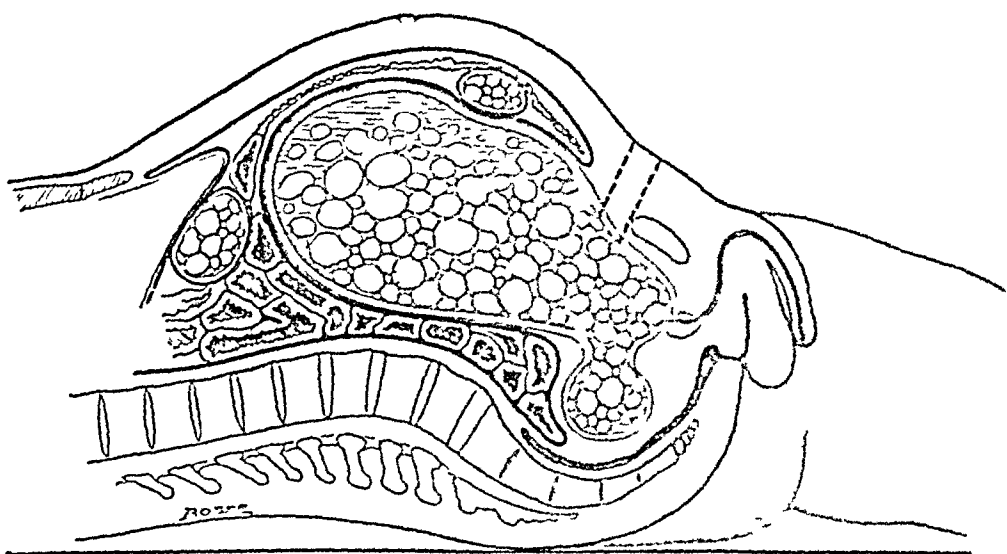
Condition after second operation. Liver cyst removed

and found to be normal, the mass being situated within the peritoneal cavity. An anterior incision was then made through the right semilunaris over the region of the hepatic notch. The tumor was found adhered to the edge and under surface of the liver. It was carefully dissected away without opening its capsule and was about the size of a large orange. It proved to be an echinococcus cyst. The patient recovered from operation without incident but the cause of the bladder condition remained, as yet, unsolved. One week following this, a third operation was undertaken to close the urinary bladder and for further investigation. At this time it was still possible to fish daughter cysts out of the bladder through the suprapubic opening (Fig 3).

Preparatory to this final operation the bladder was tightly packed with iodoform gauze and the patient placed in the

whiff of nitrous oxide anæsthesia, the patient's condition not admitting of any prolonged anæsthesia or exploratory operation (see Fig 1)

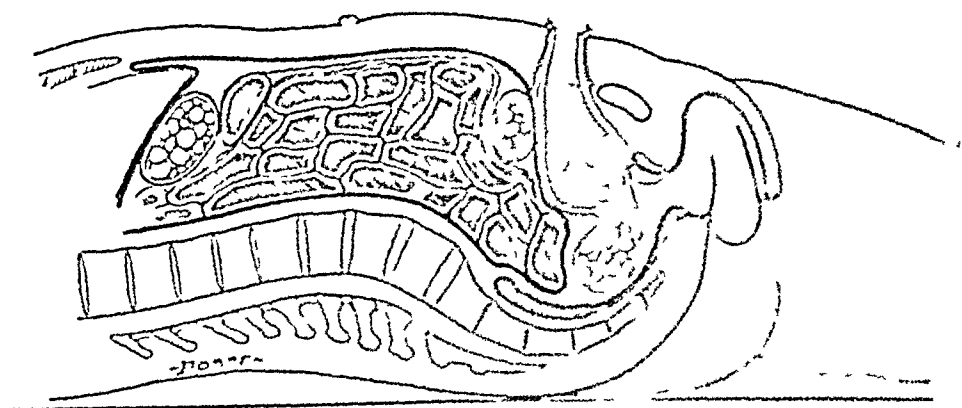
FIG 1



Original condition Rectovesical cyst, cyst distended bladder, cyst on liver surface and cyst of omentum

As soon as the bladder was incised multitudes of echinococcal daughter cysts forced themselves out of the bladder. The incision was enlarged and between two and three hundred of these cysts were evacuated from within the bladder.

FIG 2



Condition after first operation Bladder sutured to skin for drainage

The patient's condition being precarious it was decided to omit an extensive search for the mother cyst, contenting one's self with suturing the bladder to the skin and providing for constant drainage (Fig 2). The patient, following operation, un-

FRACTURE OF THE PENIS.

BY ABRAHAM O. WILENSKY, M D.,

OF NEW YORK,

Attending Surgeon, Mount Sinai Hospital Dispensary, Adjunct Attending Surgeon, Bronx Hospital and Dispensary

INJURIES of the penis, occurring as the result of the ordinary accidents, incident to the carrying on of our daily life, are fairly common. These include contusions and hæmatomata, and tears and lacerations of the body of the organ, usually communicating with the exterior, either through the outside skin, or very frequently through the urethra, the tear in the latter cases extending from within the canal outward. These injuries may be the result of a fall astride a fence or other sufficiently large object, or the result of a kick or blow, directed at the genitalia. Whenever a tear extends through the urethra, the urethral lesion should be regarded as the principal one.

Subcutaneous rupture of the penile body, or fracture of the penis, occurring during intercourse, is a most unusual accident, and of such an unfortunate happening, we have recently had an example at our clinic in the Mount Sinai Hospital Dispensary.

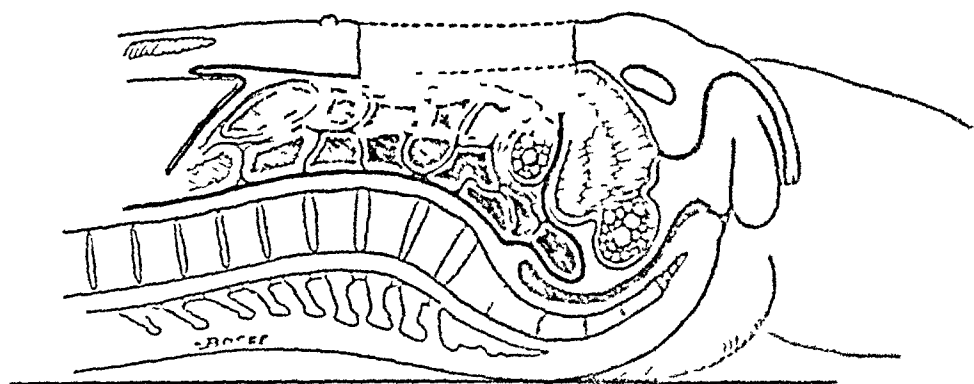
CASE No 950, series of 1912 —A very thoroughly frightened Italian, thirty-six years old, appeared at the clinic, with the story that early that morning, during intercourse with his wife, he had experienced a sudden severe pain in his penis, that he had withdrawn it immediately thereafter, and that it had then swollen very quickly, and had assumed the shape and appearance shown in the accompanying drawing (which is about one-half the actual size of the damaged organ). The patient was able to void voluntarily, the resulting urine being free from blood. Three months previously, he had had an attack of gonorrhœa, and had been treated only indifferently well, there had been no complications.

Trendelenburg position The peritoneal cavity was opened by a median abdominal incision running upward from the suprapubic incision (Fig 4)

The omentum was adherent to the peritoneum covering the fundus of the bladder and a small echinococcus cyst was discovered at the point of adherence on the right side. This cyst was excised without rupture

The attachment of the bladder to the skin (result of first operation) was loosened and the peritoneum stripped off the fundus of bladder The existing incision in the bladder was carried around behind and a perfect view of its interior obtained The bladder was found free of cysts or of cyst wall detritus, but an opening was discovered in the trigone about the size of a half dollar This opening communicated with a large mother cyst.

FIG 4

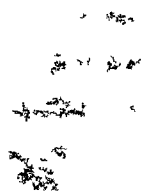


Third operation, first step Removal of cyst of omentum (bladder packed with gauze)

situated between the rectum and bladder below the peritoneal reflection The mystery was at once cleared up: The daughter cysts were being manufactured in the mother cyst and the urinary bladder had been used as a storehouse for them until nature had objected to the overcrowding From this point on, the surgical management of the case was as follows A sponge holder, carrying a small gauze wipe, was introduced into the mother cyst through the opening in the floor of the bladder and then pushed down towards the perineum A perineal dissection was then made between rectum and prostate and the cyst capsule pulled down, incised, and sutured, to the skin of the perineum (Fig 5).

Through this perineal opening the mother cyst was curetted and pure carbolic acid applied to its wall

1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2673, 2674, 2675, 26



Echymotic infiltration of the perivascular space

He had been told, that for his present trouble an amputation of the penis would be necessary.

A word in regard to the anatomy of the penis may not be amiss. It is made up of three bodies, which histologically are composed of erectile tissue. The two dorsal bodies, or corpora cavernosa, are side by side, separated by a very dense and firm fibrous septum, and together they furnish the groove, on the ventral side of the organ, which receives the third body, or corpus spongiosum. Each body has a similar structure, that is, a mass of erectile tissue, contained in a strong envelope, made up of connective tissue fibres, smooth muscle cells, and elastic fibres. The tunica albuginea of the dorsal bodies is very thick and strong, that of the spongy body is thin and weak, and shows a predominance of elastic tissue and smooth muscle cells. The reason for this is apparent when we remember that the corpus spongiosum lodges the canal of the urethra, there being a distinct strata of smooth muscle cells directly surrounding the canal. The relative thinness of structure of the sheath of the spongy body furnishes a point of election for the reception of injuries, its proximity to the canal of the urethra, inflammatory changes, which predispose to their occurrence.

The term "fracture" as applied to this condition is a misnomer, inasmuch as it implies a lesion of bone. In the human subject, there is no os penis, a condition which is regularly found in some of the lower animals. In these animals, curiously enough, fracture of the penis never occurs. In the human subject, we occasionally come across patients, who have collections of bony tissue of larger or smaller degree, usually gathered either in the septum, or in the tunica on its dorsal aspect. These are not true penile bones, but pathological conditions, the result almost always of syphilis, in combination with a local continuous irritative trauma, as from the wearing of a corset.

In the *Fortschritte auf dem Gebiete der Röntgenstrahlen*, for 1905, Brohl cites a case of a young man of twenty years, with an os penis. The X-ray photograph shows the shadow of a central column with two lateral

ing the kink nearest the valve, could be entirely separated from the underlying mesentery. This band was simply divided and its division caused almost no bleeding and left no raw surface.

Division of the second band left a denuded surface which was covered by drawing peritoneum together in direction perpendicular to the gut.

The appendix, which was quite normal and lay behind and to outer side of cæcum and reached to the liver, was removed and stump inverted. Uneventful recovery. Feels better now (September 20) in every way. Bowels now move regularly, twice a day, without purgatives.

It is to be noticed in this case that the point of tenderness was over the site of the "kinks" and not over the site of the appendix.

CASE VIII—U S P, seaman, U S Navy. Admitted August 6, 1913.

History—Severe furunculosis of back for past seven months, frequent headaches for the past six months, constipation for the past seven months. Six months ago severe attack of pain in right iliac region, lasted thirty minutes, nausea but no vomiting.

Three months ago, second attack. Three weeks ago, third attack. One day ago, fourth attack. First attack most severe. In all attacks pain is limited to the right iliac region. There has been no epigastric or general abdominal pain at any time.

Examination—A well-developed, well-nourished boy of twenty-one years, whose back is covered with a great number of furuncles for which he has been continuously under treatment since February 2, 1913.

Abdominal palpation shows tenderness over entire right side of abdomen most marked near McBurney's point. The point of maximum tenderness is rather strictly localized.

Operation (September 3, 1913)—Ether, right rectus incision. A long slender appendix is found which is adherent to the under surface of the mesentery of the ileum at a point about one inch from its tip. From this point numerous fine bands run to the lateral wall of the ileum at a point about three inches from the ileocæcal valve. When the ileum is lifted up these bands produce a marked kinking at their point of attachment. The appendix is absolutely normal. Appendix removed, stump inverted. The bands are divided and the raw surface is covered by bringing to-

lost in all but the least severe cases. Sometimes, even in the bad cases, the penis may regain this power, but it then does so in two stages: the part posterior to the lesion becomes erect, and following that, the part anterior is distended with blood.

One frequently sees men, in the organs of whom one can feel small shot-like bodies, attached to the tunica albuginea, and freely movable under the skin. These are the scars of small hæmatomata, resulting from minute lacerations, which were practically symptomless.

Most of these patients give a history of one or more attacks of gonorrhœa, and in these it is found that the inflammatory process has spread outside the urethra, and has infiltrated the fibrous septa, and so formed a *locus minoris resistentiæ* for the occurrence of these lacerations. Infection of the hematoma is rare, and if it should become infected, the matter may become very serious: gangrene of the tissues may take place, and sloughing occur.

The lesion occurs almost always during coitus, it has been known to occur during masturbation. At the moment of happening, a distinct cracking noise may be audible; there is sudden intense pain, and the organ immediately becomes flaccid. Within a few minutes, however, it begins to enlarge, and attains a perfectly enormous size. This is due to the associated œdema. The primary pain is succeeded by a painful sense of fulness. Ecchymosis is very marked. The lesion is typical: the organ bent on itself, the enormous size, the subcutaneous extravasation of blood. The absence of bleeding from the meatus distinguishes it from laceration of the urethra.

The line of treatment followed out in the past has generally been an expectant one. The patient has been kept in bed, and cold compresses have been applied locally. Fair results only have been obtained. Leguen and Michon recommend exposing the site of fracture, turning out the clots, and approximating accurately, by suture, the torn surfaces. They claim that no deformity follows, and there is better expectation of the part regaining its power of erection.

branches, composed of bony tissue. A true os penis is a thin pencil shaped bone, pointed at its free extremity, and broader at the root of the organ. The case cited is evidently one of syphilitic calcification of the fibrous septum.

One finds very little regarding this condition in the literature of medicine. It is first mentioned in 1849, in the *American Journal of the Medical Sciences*, the article being referred to in *La Gazette des Hopitaux*, of the same year. Prior to 1887, there are but five references to this lesion, and since then the references are few and far between.

There is no point of election for the position of the fracture. It may be at the centre or at either end of the penis. The tear always takes place when the organ is in the erect condition. Owing to the fact that the tunica of the spongy body is weaker and thinner than that of the corpora cavernosa, the tear almost always begins in the former, and may or may not extend into the latter. It is never very deep, for the reason, that as soon as the tunica begins to tear, the erectability of the penis is immediately disturbed, the organ becomes flaccid, and the tearing process, of necessity, stops. The tear as a rule does not extend through into the lumen of the urethra, and whenever we find free bleeding from the meatus, the lesion is a laceration of the urethra, with the tear extending for a short distance into the substance of the spongy body. One should not confuse these two conditions, as one is very apt to do, in looking through the literature.

Free bleeding always occurs under the skin, and a large hæmatoma forms, in addition the penis enlarges enormously from an associated œdema. At the line of fracture, a bending of the organ takes place, this may be very acute, as in the case reported herewith. It occurs mechanically, owing to the fact that the penis becomes longer on the torn side. Of course the concavity of the deflection is toward the untorn side.

When the process is not disturbed, the hæmatoma is slowly absorbed, and is replaced by a hard scar. Deformity, of more or less extent, usually persists, and the power of erection is

FOR THERAPEUTIC PURPOSES.

At the present time very few doubt the therapeutic effect of the bismuth paste in old chronic sinuses and empyema.

In our series of cases treated at the North Chicago Hospital we have used the paste in practically every variety of chronic suppurations. We have treated sinuses resulting from spondylitis, hip-joint disease, tuberculous knee, ankle, shoulder, wrist and ribs, osteomyelitis in all parts of the osseous system, including the clavicle and fibula; further, chronic suppurations of soft structures, such as sinuses after extirpation of kidney, broken-down tuberculous glands, rectal fistulæ, and sinuses following laparotomies. The accessory sinuses of the head and the fistulæ of the alveolar process have also been treated by this method by my brother, Dr. Joseph C. Beck. Only fistulæ of the gall-bladder, the pancreas and those communicating with the cranial cavity have, for obvious reasons, not been treated, with the exception of one case of biliary fistula referred to me by Dr. Robert Morris, of New York, in which I tried it and obtained a splendid result. I shall reserve a tabulated report of our series of 1100 for another publication, but our results obtained so far have greatly exceeded those reported in the past.

We have learned from experience, and by improving the technic as well as by avoiding complications, to cope with the most hopeless cases, so that the percentage of complete cures has increased every year.

Statistics.—In order to reach a just conclusion as to the therapeutic results, I do not propose to hold up my own results as a criterion, I prefer to quote the average from the cases recorded in medical literature.

It is impossible to estimate the extent of the use of this method, because the bulk of the cases come into the care of the office or the patient's home, and thus only a small fraction of treated cases are published. Some large hospitals in this country, and clinics abroad, as well as individual surgeons, have from time to time made reports of their experiences, the collective summary of which up to 1913 is as follows:

LITERATURE

- Kaufman Deut Chir, Bd 50a
Winnwater in Frisch u Zuckerkandl's Handbuch d Urologie
American Journal of Medical Sciences, April, 1849, Ref
Mianowski Acad Med Chir cura edit Vilnæ, p 233
Val Mott Dublin Med Press, 1851, p 17
Demarquay et Parmentier Monit des Sc, 1861, Nos 41 and 43
L Parker Br Med J, 1868, May 16
P Cami-Debat Paris Thesis, No 226, 1885
H Mende Inaug Diss, Greifswald, 1892
Wilson Br Med J, 1897
v Bramann Handbuch der Prak Chir, Bd 3, 1901
Kocher and de Quervain Enzyklo d Ges Chir, 1903
Brohl Fort auf d Geb d Roentgen, Bd 7, H 3, 1903

Name	Number of cases	Percentage of cures
Ochsner, Chicago.....	20, tubercular sinus	55
Ridlon and Blanchard.....	17, tubercular sinus	53
Beck, E. G., Chicago	192, collective report	64
Robitecksh, Minneapolis	9, tubercular sinus	55
Don, Edinburgh.....	6, tubercular sinus	17
Rosenbach, Berlin.....	4, tubercular sinus.....	50
Dollinger, Budapest	16, tubercular sinus	12½
Beck, J. C., Chicago.....	319, accessory sinuses.....	22
Pennington, Chicago	17, rectal fistulæ	76
Baer, Baltimore.....	12, tubercular sinus	33½
Stern, Cleveland	4, tubercular sinus	100
Steinman, Muenchen.....	5, tubercular sinus	20
Bogardus, U. S. A.	1, tubercular sinus	100
Vidakovich, Russia	2, empyema	100
Nernanoff, St. Petersburg.....	6, empyema	100
Ochsner, A. J., Chicago	14, empyema	85
Beck, E. G., Chicago	11, empyema	82
Ely, New York.....	14, tubercular sinus.....	43
Cincinnati.....	9, tubercular sinus.....	89
Chicago.....	1, intestinal fistula	100
Budapest	2, otologii	100
Morens, Paris	11, renal sinuses	73
Philadelphia.....	25, tubercular sinus	54
New Orleans.....	5, tubercular sinus	80
Vienna	4, tubercular sinus	50
Porto Rico.....	15, tubercular sinus	30
Rivero, Porto Rico.....	8, tubercular sinus	75
Goror, E., Paris.....	2, tubercular empyema	66
Reichelfelder, Washington.....	4, tubercular empyema	75
Brandes, Kiel.....	29, all varieties of sinuses	76
Beck, R., Chicago	58, alveolar sinuses.....	54
Beck, R., Chicago	9, empyema antrum.....	66
Collective reports from 19 dental surgeons in U. S. A.....	39, alveolar sinuses.....	74
Collective reports from 19 dental surgeons in U. S. A.....	4, empyema antrum.....	100

It must be taken into account that this represents a class of cases in which other treatment had previously been applied and had failed, some cases had even passed through a series of as many as twenty unsuccessful surgical operations, often the disease having lasted many years, yes, as many as forty years, as occurred in two of my cases.

An example or two may serve as an illustration of the therapeutic possibilities.

Hip-joint disease of sixteen years' duration. Fifteen operations. Injection of paste. Closure in thirty days.

Miss M. G., aged twenty-one, developed a painful condition

cause of death in these cases? Up to date an extensive literature has grown up on this subject, but there appears to be as yet no unanimity of opinion

The theories advanced as a cause of death in ileus uncomplicated by peritonitis are, that it is an auto-intoxication due to an absorption of toxins from decomposing intestinal contents, that it is a bacteræmia or a septicæmia, that it is due to an absorption of an altered chemically toxic secretion of the duodenum, that it is due to a reduced blood-pressure, an exhaustion or a collapse, brought about by the enormous loss of fluids from the blood- and lymph-systems, caused by the increasing intestinal transudation, in time producing anæmia or a devitalization of important centres in the brain, or that it is a reflex phenomenon due to an irritation of the central nervous system

The prevailing impression in regard to the cause of death in ileus seems to be that it is a toxic condition originating from the absorption of bacteria or their toxins or from the absorption of some altered physiologic secretions of the pancreas, liver and intestinal mucosa. If this is so, it ought to be possible, in some manner, to demonstrate such poisons experimentally

For our experiments dogs were used. Obstruction of the bowel was performed high, that is about 8 inches from the pylorus or about 2 or 3 inches distal to the opening of the bile and pancreatic ducts

Dogs with complete obstruction of the bowel at this point, uncomplicated by peritonitis, lived from 40 to 108 hours, the average time being about 69 hours. For from 30 to 40 hours after the obstruction was produced, the animal would move about. The clinical syndrome in each case was typical. There would be vomiting and after 40 hours the animal would lie down most of the time. Muscular tremors, localized in certain groups of muscles, would appear. A certain muscular stiffness could also be noticed in certain cases. The animal would remain between a semicomatose condition and death for two, three and even four days. The overfilled stomach would

of her right knee and hip at the age of six. For one year she was treated symptomatically, and then a diagnosis of hip-joint disease was made by aspiration of pus from the hip. Incision and drainage (at the time considered the proper procedure) made. Condition was thus aggravated, and after six months of extreme suffering, often requiring chloroformization during dressings, a radical operation was performed, consisting in the resection of the head of the femur. This radical procedure, however, resulted in the formation of many sinuses and the persistence of fever. During the following ten years she submitted to thirteen more or less radical operations, at intervals of from six months to three years, all of which, however, were of no avail. The discharge and pain persisted. The last operation was performed by Professor Senn, in June, 1907. It was the most radical procedure thus far undertaken. Both trochanters were removed, and the acetabulum was thoroughly curetted. The five sinuses, however, kept on discharging pus. In December, 1907, the first injection of bismuth paste was made, and repeated every two or three days, and on January 15, 1908, the sinuses were closed and have remained thus for 6 years. The radiograph (Fig. 6) shows the extreme destruction of the joint, the end of the femur, including both trochanters, having been removed. The rim of the acetabulum is filled with bismuth paste, showing distinctly a collateral sinus.

Causes of Failure.—To explain the varying results among different authors, many factors must be considered. During my visits to various hospitals and clinics in America and Europe, I have had some opportunity to observe why some men have failed to obtain the best results and I shall enumerate the causes which I believe are responsible for the failures.

We must bear in mind that a sinus or fistula is nothing more than a shrivelled abscess or abscesses. No sinus originates by burrowing its channel from one end to another. The focus of the disease is often at a considerable distance from the opening or openings of the sinus. It is, therefore, inconsistent to try to eradicate the suppuration by only dissecting the sinus tracts. With the radiographic reproductions of the

weighing 7 pounds was used. The intestinal contents were filtered through filter-paper, and with the filtrate as a diluent a 4 per cent tricresol solution was made, 40 c c of this solution were then injected subcutaneously (This amount, for a dog weighing 7 pounds, is equivalent to about 35 c c for a guinea-pig and 850 c c, or about 28 ounces, for a man weighing 150 pounds). This solution, if at all toxic, certainly ought to show its toxicity in some form or other when injected into animals in such large proportions.

Second Series of Experiments, Injection of Serum—If the dogs died of toxæmia, the toxic material, whatever it might be, must be circulating in the blood-stream in order to cause its fatal effects. Whatever is in the stomach or bowel is, so to speak, outside of the body. For this reason the toxicity of the serum of the ileus dogs was tested. The first dogs were allowed to die, but, as after death it was difficult to withdraw a sufficient amount of blood from which to separate out the serum, the dogs used later were allowed to live 48 hours (at which time their symptoms seemed most severe) and then bled to death.

Cultures were made from the blood, serum and peritoneum of all these animals, and in each case in which the peritoneum showed an absence of bacteria the blood and serum gave the same negative result. When peritonitis was present (which animals were not used) bacteria resembling the colon bacillus and *Staphylococcus albus* could also be demonstrated in the cultures taken from the blood of these animals. Such positive results were not, however, constant. The serum of ten dogs was injected into twenty-five guinea-pigs subcutaneously and peritoneally. From 15 c c to 3 c c were used. Whether the intraperitoneal or subcutaneous injection was used seemed to make little difference. The guinea-pigs that received 3 c c died, about half of those that received 2 c c died and the others remained well and lively, only one of those that received 15 c c died.

In the process of the clotting of blood, the leucocytes, as is well known, are squeezed on and certain enzymes are forced out of their protoplasm. It was thought that the enzymes might have some neutralizing effect on the toxins circulating in the serum, if any such there are. For this reason the blood was prevented from clotting by allowing it to run, while bleeding, directly into a 1 per cent solution of sodium citrate. Equal parts of blood and sodium citrate solution were used. The mixture was then centrifuged. Of this mixture of sodium citrate and serum, 4 c c were injected into six guinea-pigs (Serum from three different dogs was used).

This mixture had about the same effect as did the plain serum. One guinea-pig died, the five remaining continued lively and well. The guinea-pigs were observed for about five days and then released.

What was the cause of the varied outcome of these injections of "ileus serum"? Is dog serum a foreign protein for guinea-pigs and does the injection of such foreign protein cause anaphylaxis? If it does, normal dog-serum ought to have the same effect and this, we learned later, is precisely what normal dog-serum will do. Testing normal dog-serum on guinea-pigs we found that over 2 c c will invariably kill, that 2 c c and

the transverse colon, which it filled about half its length across the abdomen, where it was finally arrested, and repeated observations during a period of an hour failed to show it filling the remainder of the colon. After an interval of ten days a confirmatory examination was made and 2000 c c of enema, instead of 1500 c c, was used. At this time the same observations were made. This enema was again delayed at the splenic flexure, widely dilating the descending colon below, and again after six or eight minutes the enema was seen slowly passing through the splenic flexure to fill the transverse completely this time, and then the ascending colon and cæcum. A plate was then taken which pictured the distended descending colon with a blurred outline at the splenic flexure.

The patient would not permit an examination with the bismuth meal given by the stomach to detect the degree of obstruction when the colon contents approached the splenic flexure the natural way.

The X-ray diagnosis was partial obstruction at the splenic flexure. From the other signs and symptoms it was inferred that the obstruction was probably malignant. At operation a condition of *extensive pericolicitis involving the splenic flexure and descending colon* was found, as is fairly well illustrated in Fig 1. The left lateral margin of the great omentum was attached to the serosa of the splenic flexure and descending colon by thin sheets and bands of peritoneum, which apparently had been formed by fusion of the anterior and posterior peritoneal laminae of the omentum. These fused peritoneal layers of the great omentum passed in front of the descending colon and blended in with the left lateral abdominal serosa¹. The whole of the descending colon was thus invested almost to the beginning of the rectum. It was, however, not possible to draw up a single sheet or sleeve of peritoneum as has been observed upon the right side. The picture was not unlike that of ordinary membranous adhesion formations which might attend or be consequent upon peritonitis, although there was, in this case, no history whatever of peritonitis.

¹The phrenocolic ligament of Toldt is derived from the great omentum. It passes over the splenic flexure to adhere to the parietal peritoneum opposite the tips of the tenth and twelfth costal arches—
D G Reid

for by this method alone we were able to judge just how much "ileus blood" it received. This procedure was repeated seven times. In the first three cases both dogs were anesthetized with ether, but the ether anesthesia, in itself a toxæmia, caused vomiting and stupor and therefore interfered with correct deductions, local anesthesia was then used, and in every case after the transfusion was completed the dog would jump up, be as lively as before and continue in the same state, absolutely normal. The amount of blood the normal dog received varied somewhat. As will be seen from Table I, the average weight of the recipient dog was $13\frac{1}{2}$ pounds and the average amount of ileus blood he received was $13\frac{2}{5}$ ounces.

TABLE I—RESULTS IN EXPERIMENTAL DIRECT BLOOD TRANSFUSION¹

Weight of dog before transfusion	Weight of dog after transfusion	Amount gained after 50 c c or 2 oz blood withdrawn	Amount in c c of ileus blood normal dog received
<i>Pounds</i>	<i>Pounds</i>	<i>Ounces</i>	<i>cc</i>
17	$17\frac{1}{2}$	10	300
15	16	18	540
15	16	18	540
13	$13\frac{3}{4}$	14	420
10	$10\frac{1}{4}$	6	180
11	$11\frac{1}{2}$	10	300
15	16	18	540
Total 96	101	94	2820
Average 13 7	14 4	13 4	402 8

The largest amount was 540 c c (18 ounces) and the smallest was 180 c c (6 ounces). The normal amount of blood in a dog weighing 13 5 pounds, the average weight of the recipient dog, is about 15 4 ounces. By volume, therefore, the amount of ileus blood (402 6 c c or $13\frac{3}{10}$ ounces) the recipient dog received was 2 ounces less than the normal amount of blood contained in that dog.

If the ileus blood which the normal dog received contained some toxic substance surely the reception of such a large amount ought to cause symptoms similar to those observed in the ileus dog. This was not the case. There was not even vomiting and the dog soon after apparently ate a hearty meal. It might be interesting to observe that the average amount of blood the dog received in the transfusion would, in a man weighing 150 pounds, be equivalent to $4\frac{1}{2}$ quarts.

After reviewing these experimental facts can we still hold that death in ileus is due to a toxæmia? We have been unable to demonstrate bacteria in the blood, and likewise by injecting the duodenal and stomach contents, by injecting the serum, by injecting the gas elaborated, and lastly, by direct transfusion.

¹ McLean and Andries, Journal A M A, Nov 2, 1912, page 1614.

The dogs lived from 40 to 108 hours, an average of 67 hours, and during that time the weight lost was from 1 to 5½ pounds, the average being a little over 3 pounds. Some of the dogs had a full stomach at the time of operation, and if we deduct the weight of the vomitus during the first two hours after the operation, that is, the amount of food débris contained in the stomach at the time of the operation, the average amount of weight lost would be 2 pounds.

For animals weighing on the average of 20 pounds, that is, the average weight of the animal two hours after the onset of ileus, the loss of 2 pounds is quite considerable. It is a loss of about one-tenth of the whole body weight. This in a man weighing 150 pounds would be the equivalent to a loss of 15 pounds and that in the short space of three days. This loss of weight must be attributed principally to a loss of body fluids that have been discharged through the bile passages and pancreatic ducts and that have otherwise transuded through the intestinal mucosa, and have been expelled as vomitus and urine.

When we consider that the proportion of blood to the other elements of the body is, weight for weight, about one-fourteenth, and that the loss in ileus animals is about one-tenth, all due to the loss of fluids, then we can readily understand how this must have a detrimental effect on all the body functions. It must certainly have an enormous effect on the blood-pressure.

We have not conducted any experiments on the blood-pressure of dogs dying from ileus, but Braun² showed very conclusively by a long series of experiments that the death of dogs that died from ileus without peritonitis differed in no way from that of those that were bled to death slowly. Besides the blood-pressure, which in each case was similar, the general clinical picture, he asserted, except for the vomiting in ileus animals, was also similar. Accordingly, the disordered functioning power of the bowel, with its direct depleting effect on the abdominal blood-vessels and consequently on the whole vascular and lymph system, causing a steady sinking blood-pressure, and a necessary consequent disturbance in the cerebral

trophy or chronic lobular prostatitis already described (Figs. 42-44).

Serial sections never reveal the presence of the ejaculatory ducts within it or of striped muscle fibres coating the specimen.

A fatal issue may ensue even in such a case, however, and a further opportunity be afforded of observing what the operation accomplished locally. In order to investigate this latter question, I have studied the pathology of eight fatal cases following prostatectomy. The pelvic viscera were hardened *in situ* and thereafter complete celloidin sections of the prostatic bed and adjacent viscera were made and examined microscopically. For our present purpose, one typical case will be referred to.

The case was that of a man who suffered from typical prostatic dysuria from prostatic hypertrophy. The gland was extracted without difficulty. He died, however, on the fifth day from pelvic cellulitis, owing to infection through the space of Retzius. Fig. 45 is a vertical median (sagittal) section traversing the prostate and prostatic urethra which was removed. Fig. 46, a similar section of the prostatic bed left after removal. Fig. 47 is a composite superimposed photograph with the gland replaced within the cavity from which it was extracted by operation. Owing to the contraction of the cavity of the prostatic bed, the photograph of the prostate had naturally to be reduced in size to permit of this. When Fig. 46 showing the prostatic bed is examined, it will be noticed that the stretched internal vesical sphincter surrounds the upper vesical entrance to the cavity. The thick, smooth covering of the false capsule lining the space is visible. Microscopic examination shows this coat to consist of condensed prostatic tissue, consisting mainly of muscle fibres and fibrous strands with compressed and atrophied gland acini amidst the fibres. The ejaculatory duct is clearly shown traversing the posterior wall of the space from the seminal vesicles above. Below and behind the ejaculatory ducts, the compressed and atrophied posterior lobe is seen lying between the false capsule and space of Denonvillier.

The undamaged external vesical sphincter and recto-urethralis muscles are seen beneath the prostatic bed. Fig. 47, where the tissue is superimposed within the cavity from which it was ex-

from as the source of the clinical picture of ileus, then efforts must be directed toward these factors. Rational treatment must therefore, first, subdue the distention, which is continually increasing and at the same time increasing the paralysis of the bowel, in the same manner as overdistention of the bladder brings on a paralysis of the musculature of this viscus, and, secondly, it must replace the lost fluid in the vessels. The former condition, the distention, can often be relieved in mild cases by stomach lavage and enemas, but in severe cases, surely by ileostomy. Ileostomy, by relieving the distention in practically an instant, allays at the same time the irritation in the paralyzed gut and so inhibits the further influx of blood to the abdominal blood-vessels, the latter condition, the lost fluid or the exsanguination that has taken place, can only be restored by a refilling of the vascular system. This can best be accomplished by the free administration of saline solution intravenously and subcutaneously and fluids by rectum.

In our general surgical practice during the past three years we have been adhering to these rules very closely. With free use of saline and early enterostomy we believe that we have saved 65 per cent of cases of severe ileus, that is, cases we feel sure would have terminated fatally had we not resorted to these measures. Our cases of ileus in almost all instances have been confined to the small intestines, and strange to say, have always followed operations performed in the lower abdomen. This we believe is due to the fact that in operations in the upper abdomen there is practically no disturbance of the small intestines and its mesentery.

In our work we usually make two practical divisions of ileus. These divisions are aseptic or noninfectious and the infectious or ileus accompanied by peritonitis.

When ileus is complicated by peritonitis or *vice versa* if you will, peritonitis complicated by ileus, it is not so much the peritonitis that proves fatal, it is the ileus. Formerly we attributed the death in these cases as due to the septic peritonitis but now we know that if we overcome the ileus, if we subdue the distention and stop the regurgitant vomiting by ileostomy,

THE TREATMENT OF UNUNITED FRACTURES OF THE TIBIA BY THE TRANSPLANTATION OF BONE.

BY M. S. HENDERSON, M.B. (Tor.),

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UNUNITED fractures of the tibia are relatively common, especially in the middle and lower third of the bone. It is true that we do not see cases of such long duration as those of ununited fractures of the humerus which may be of five and ten years' standing. In one case, recently operated on in the Mayo Clinic, the humerus had been ununited for fourteen years. An arm thus partially disabled is infinitely more useful than an artificial arm and is not, therefore, sacrificed. On the other hand, an ununited fracture of the tibia necessitates the use of crutches or, for a laboring man, complete cessation of work. In such cases an artificial limb is more useful and therefore the legs are sometimes amputated.

The ingenuity of the surgeon has been greatly tried in the treatment of these cases. Many procedures have been advocated, prominent among which, of late years, have been the silver wire and the metal plate. The plate is best suited for certain recent fractures in the tibia in which apposition of the fragments cannot be maintained in any other manner. A perfect anatomic reposition of the fragments is not essential for excellent function. A little displacement is permissible if the axis of the line of weight-bearing in each fragment is parallel, but weight-bearing through an angle is bad, particularly if the fracture be near the joint.

Transplantation of bone into the tibia gives excellent results and the method herein described is so simple and reasonable that it must inevitably supersede the use of the plate or other mechanical devices in the majority of cases.¹

¹ In describing this method the author makes no claim for originality. Others have used practically the same procedures. Buchanan published an article and reported a case (*International Journal of Surgery*, October, 1912).

3 A pathologic change in the sympathetic nervous system, a loss of sympathetic control, is probably contributory

4 Ileostomy at the primary operation should be resorted to in all the severe cases of peritonitis with overdistention of the abdomen. These operations should, when possible, be performed under local anæsthesia

5 It is our opinion that many patients suffering from peritonitis and ileus die, not of the peritonitis, but of the ileus

6 All treatment must be directed to the relief of the distention and to the refilling of the depleted vessels for which ileostomy and the free use of fluids are our sheet anchor

It was noted in these cases that the fibula when fractured had united. If these patients have been previously operated on or if there is much laceration of the skin at the time of the accident, the difficulties in operating are greater. This scar which is closely adherent to the bone, poorly nourished and deprived of subcutaneous tissue, is liable to slough after being lifted up, a complication which occurred in two of our cases. No infection followed but careful dressings were necessary after the slough had separated until healthy granulations appeared.

In the treatment of cases of ununited fractures, enough bone for transplantation can be obtained from the same leg, thereby greatly shortening the patient's stay in bed. The transplanted bone will live if the following conditions are fulfilled: (1) The observation of asepsis; (2) if bone be obtained from the same individual; (3) securing a free supply of blood in the new habitat; (4) maintaining a reasonable amount of bony contact.

This procedure is not recommended for the infected case, although some surgeons have transplanted bone with infection present and obtained good results. When infection is present the bone to be transplanted should first be removed from the other leg and all work completed on this leg before the infected member is touched.

The question here arises: When are we to transplant bone for fractures which have not united? Robert Jones² speaks of the condition as "delayed union." This is a better nomenclature than "non-union" since it is probable that all of these fractures would unite in time. However, with the present-day advantages of surgery an operation for this condition may be advised, thereby saving time for the individual and an earlier return to his wage-earning capacity.

There can be no definite period assigned for transplanting bone in these cases of delayed union. Many factors should be considered, but the chief aim of the surgeon is to restore the individual to his duties at the earliest possible period.

² *Amer. Jour. Orthop. Surg.*, October, 1913.

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There is generally but little deformity in the fractured tibia and good alignment and position may usually be maintained by the aid of plaster-of-Paris casts or splints. It is difficult to understand why union should not take place in these cases. The type of cases under consideration in this paper does not include the so-called Pott's fracture. Here it is true that the tibia enters into the question, but non-union rarely results and these patients usually seek relief because of faulty alignment which so intimately involves the ankle-joint as to demand correction.

The 9 cases herewith reported were all healthy young males—one a boy 8 years of age. Syphilis was present in but one, and this was contracted after the leg had been broken one year. In the series of 9 cases, 6 were simple fractures and 3 were compound fractures. One of the latter had become infected. The other two, although the bones protruded at the time of the accident, had healed without any signs of infection. It does not seem probable that infection had any bearing on the delay in union.

The bone in these cases is especially adapted to transplantation since it is easily accessible, the operative field being just beneath the skin. The transplant will not have to hold the alignment because this can readily be done by external means. The fibula, which is intact or firmly united, maintains the length of the limb and no slipping-by of the fragments is likely to occur. The transplanted bone may be placed in a normal field; it is not necessary to put it in the medullary cavity. A gutter is chiselled or sawed in the fragments down to the medulla, thus allowing the transplant to have a natural bed to rest in. If a piece of cortical bone is used as a medullary plug it acts merely as a foreign body. It is, however, an absorbable foreign body and gradually disappears. During its absorption, osteogenesis is promoted, which leads to union. In operating on cases of ununited fractures of the humerus, 25 years ago, C. H. Mayo used an ordinary cataract bone knife-handle to make an intramedullary plug. He fastened linen sutures to its centre, leaving long ends, and brought these out through

OBSTRUCTIVE PELVIC LESIONS ASSOCIATED WITH CHRONIC DIVERTICULITIS.*

BY GEO ERETY SHOEMAKER, M D,
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THE attention of surgeons has been directed of recent years to diverticula of the intestine as a cause in certain previously very obscure chronic indurated conditions. Suspicions of tuberculosis or syphilis, but especially of carcinoma, have led to exploratory operation, the pathology being finally determined as that of chronic diverticulitis. Often after most difficult dissection drainage of a small abscess in the centre of a rigid induration has been the only treatment possible. Curative treatment has required excision or resection of the bowel, a matter of much technical difficulty at times. Among the last 800 intra-abdominal operations by the writer five cases of various forms of diverticulum have been encountered, some of minor consequence, others of much gravity. They were as follows

CASE I—*Meckel's Diverticulum* Incidentally observed while operating for extra-uterine pregnancy. It was a cone-shaped offshoot of the lower ileum. As its opening was large and there was no danger of subsequent strangulation it was treated by inversion and suture. Probably it had not caused symptoms. Patient was delivered normally a year later.

CASE II—*Meckel's Diverticulum* Acute obstruction of ileum. Boy of twelve years. Subsequent to recovery from typhoid fever two attacks of partial obstruction in previous months had been spontaneously relieved. The existing attack had gradually developed into complete obstruction and paresis which caused death thirty-six hours after operation, which was done too late and under unfavorable conditions. A strong broad adhesion band had strapped down an inch or more of small intestine to the root of

* Read before the Philadelphia Academy of Surgery, December 1, 1913

the wound. These sutures were tracted every day, thus causing a little motion of the plug. In this way, a mild irritative osteitis was kept up which was conducive to osteogenesis and the formation of callus. This ivory plug usually healed in, but occasionally disintegrated and came out in small pieces.

If transplants are taken from the opposite tibia, patients must be kept off their feet for a month or more. It is much simpler to take the bone from the same tibia, either above or below the fracture and get our patients up within a few days. The bone should preferably be taken from the flat internal surface of the tibia rather than from the crest which is dense, strong, and being the apex of a triangle, serves a most important weight-bearing function. A piece of bone removed from here down to the medullary cavity weakens the bone out of all proportion to the size of the piece removed. The bone on the internal surface is not so dense and is also more vascular and a large piece may be removed here without greatly weakening the bone. All the layers, *i.e.*, periosteum, cortex and medullary lining, should be included in the transplant.

In studying these pieces of transplanted bone by a series of X-ray pictures after their implantation, it is apparent that they live and functionate without being replaced by new bone. In the tibia, by forming a gutter down to the medullary cavity, the transplant can be placed so that periosteum meets periosteum, cortex meets cortex and medullary lining meets medullary lining, thus obtaining an anatomic approximation favorable to rapid healing.

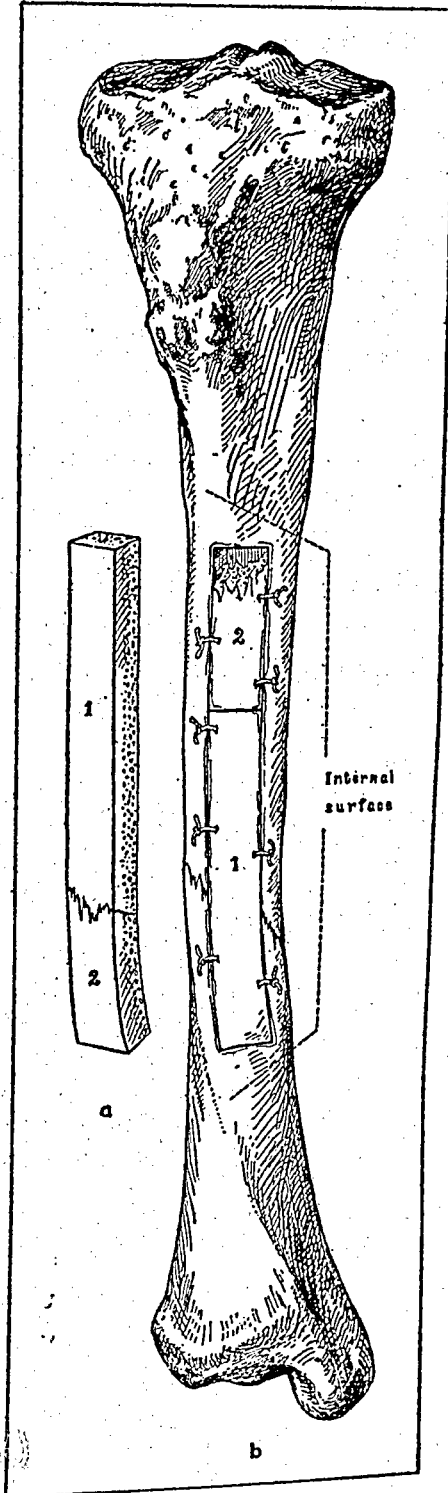
The technic of the operation, as followed in our more recent cases, is simple and may best be shown by the diagram (Fig. 1). Either by the aid of the chisel or the motor-propelled circular saw (Fig. 2), a piece of bone is removed from the internal flat surface of the tibia. The bone should be of sufficient length to make a substantial bridge, usually 2 or 3 inches long and about $\frac{1}{2}$ inch in breadth, and should include all the layers. This is taken from the longer fragment. A piece the same width in the same line is then removed from the smaller fragment. This is saved. The larger piece of trans-

possible, that which the vasomotor centre uses to produce its rise and fall of pressure and without which it is powerless, is hopelessly unavailable.

The amount of blood which this area will contain is well illustrated by a number of experiments which we performed, in which during the period of handling the intestines, the brain of the same animal was supplied with blood from the carotids of another dog, and in one case from the carotids of two other dogs. Before the intestines were handled, an anastomosis was made between the carotids and external jugular veins of the donor and the recipient, which was to be shocked. The purpose of these experiments was to discover whether or not any diminution of shock could be obtained by supplying the dogs being shocked, with blood from a presumably normally beating heart, thus eliminating the small fall in pressure occurring in the other transfused dog, during the experiment. In all the dogs gave the same result as the dogs transfused at the end of the experiment. The main purpose of the experiment was defeated, however, by the fact that the splanchnic area of the recipient during the period in which the intestines were handled drained off so much blood from the donor and in one case from two donors, that the blood-pressure of all donors in the three experiments fell to a serious degree, so that at the end of the experiments the donors no longer supplied the brain of the recipient with blood under good pressure, and were themselves in a serious condition from exsanguination.

Animals shocked in the manner described are deprived of all vasomotor control solely because of a local peripheral paralysis of the splanchnic area. It is as though the branches of their mesenteric arteries emptied into a large reservoir with perfectly flaccid walls, into which they bled to death. The aptness of the comparison of the splanchnic area to a flaccid rubber bag is made more apparent by pressure on the abdomen. The blood-pressure can be raised at will by this procedure. The explanation of the secondary shock developing in the transfused animals, the intestines of which are paralyzed from one end to the other, introduces very complex questions which

FIG. 1.



1a shows diagram of transplant removed from the long fragment; 2a shows transplant removed from the short fragment. 1b shows inversion of long transplant to bridge fracture; 2b shows short transplant inserted to fill gap left by removal of transplant from long fragment. Catgut sutures in periosteum of graft and shaft.

the mesentery at a point immediately below the origin of a Meckel's diverticulum. The latter was enormously swollen as was the nearby gut above. The diverticulum had apparently participated in the production of the obstruction due to kinking above the broad adhesion.

CASE III — *Multiple Diverticula of Sigmoid Bowel*. Mrs. X, aged sixty, presented symptoms suggestive of pelvic carcinoma. In addition to benign uterine hyperplasia the lower sigmoid bowel was rigid and leathery. After resection the gut was shown to be pierced by numerous diverticula. Inflammation had extended from these to surrounding tissues (see ANNALS OF SURGERY, vol lvi, p 661).

CASE IV — *Diverticulitis of Rectum*. Mrs. B, aged sixty-three, had suffered from pelvic inflammatory attacks, for years, and at times had been treated by various specialists, receiving the rest cure, etc. Operation showed broad ligaments, very small ovaries and tubes buried in very firmly organized old adhesions which also surrounded the rectum. While the entire rectum had not the rigidity and leather-like feel at times noted, there was a diverticulum readily accessible resembling a thick short epiploic appendage with a firm club-shaped head as large as a cherry. This contained a movable mass, continued pressure on which caused it to be extruded into the lumen of the rectum. The offshoot from the bowel then collapsed, showing it to be diverticulum. Deeply situated in the cellular tissue surrounding the rectum were several firm bean-sized indurations which probably represented other diverticula, though only the one was clearly demonstrable. Diverticulitis was doubtless the cause of old obscure pelvic symptoms.

CASE V — At intervals of several months during the past year I have operated for recurring intestinal obstruction under conditions which interested me greatly. The patient presented a most baffling and formidable combination of pelvic conditions, at first supposed to be carcinomatous but which were finally shown to be associated with one or more diverticula lying in an inextricable mass of indurated tissues and organs against the sacrum.

The extensive destruction and disarrangement of pelvic anatomy was remarkable. The patient, aged forty-three, short, muscular, fat, weighing 190 pounds, was admitted for an attack of intestinal obstruction which proved to be incomplete. Owing to distention little could be learned by examination above the pubis,

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relieved spontaneously or otherwise at intervals. A second focus was isolated from very hard tissue and finally detached, almost by fracture. It was found to be lined with mucous membrane. Its site was closed in by celluloid thread. No determination could be made of the kind of intestine from which it sprang but from its situation it was supposed to be also a diverticulum from the large bowel. The laboratory examination by Dr Pfeiffer showed it, however, to contain glands unquestionably from the small intestine. It was, therefore, a Meckel's diverticulum, lying deep in the pelvis and caught in the general mass. With the greatest difficulty could the uterus be found, well in front. Large cigarette drains were placed in the diverticular pus cavity and another at the suture site of the Meckel's diverticulum. There was a troublesome oozing of indefinite origin which set in after reaction and which contributed more or less to the death by exhaustion after three days. Gas was passed by the colostomy.

The occurrence of five diverticula in such a small group of abdominal operations as 800, while probably only a coincidence, would seem to indicate that the abnormality may be more frequent than is supposed. Detection of short diverticula is difficult and when buried in dense, inflammatory tissue may only be possible after resection of the intestine. Certain it is that the lesion has been often overlooked in the past, especially in the sigmoid and rectum.

Device for Temporary Gas-Tight Plugging of Colostomy During Operation on the Abdomen Elsewhere—Owing to the recurrent attacks of obstruction and the uncertainty of being able to remove the cause, it was necessary to operate without permanently closing the colon in the last case cited. The opening was therefore plugged by a finger cot of heavy type, passed part way in, then loosely packed with gauze both within and without the fistula so as to make a retention button. The cot was then tied to a catheter and inflated with air. This made a perfectly gas-tight valve, not affected by fluids or gentle manipulation. I reported the use of the same device to the Academy of Surgery in 1909 (see *ANNALS OF SURGERY*, vol 11, p 425), when it was applied to a vesicovaginal fistula. Before removing a bleeding kidney tumor it was necessary to prove the function of the other kidney, which was impossible with a bladder collapsed by the presence of the fistula.

The distended rubber cot, however, made a watertight joint and made the cystoscopy perfectly easy. Unless a little gauze is put inside the cot before inflation, the air may all go into one end of the device, which would then slip out.

below the pelvis was found blocked by a large rounded fixed mass, apparently incorporating both uterus and rectum high up. There was a history of menorrhagia, and at long intervals slight discharge of mucus, so-called, but no blood from the rectum. There had been occasionally wire drawn stools for five years.

Operation was most unsatisfactory, an irregular, very hard pelvic mass inextricably incorporated the rectum and uterus with adherent coils of small bowel. After patient dissection nothing was accomplished except the release of a few adhesions, and in the apparent presence of malignancy the colon was attached to the left parietes, to be opened later when necessary. Strange to say, obstructive symptoms entirely disappeared following this operation, and large, well-formed stools were passed. All appearance of wire drawing disappeared, doubtless due to rectal drainage of a fluid sac and release of external pressure on the rectum. This relief continued for four months, the patient becoming apparently well. Wassermann test was negative and full doses of iodide of potassium used experimentally had no effect on the tumor. Then obstruction occurred gradually, became complete, and the colostomy was completed with immediate relief. Again she resumed the use of the rectum intermittently. The colon opening might be unnecessary for weeks, when it would again come into play. There was no valve action and no slack in the attachment of the colon. Six months later and nine months after the first operation, as the general condition seemed absolutely to negative the presence of carcinoma, I yielded to the solicitation of the patient to again try to remove the obstructive mass and make possible the closing of the colostomy. The attempt was again very disappointing and unsatisfactory. After the most difficult dissection a rounded pus sac with walls half an inch thick and very firm was traced behind the rectum, but it could not possibly be dissected out and had to be abandoned to drainage. Before opening it pressure did not cause it to drain into the rectum, though doubtless this occurred at times. The rectum where it emerged above the extremely hard mass was stiffened and the local vessels were deeply engorged. The microscope afterward showed no mucous membrane lining this pus sac, but it might have been destroyed by suppurative processes during years. I consider this sac to have been a diverticulum holding about three ounces of mucus, and so surrounded except on the rectal side by absolutely rigid tissue that when full it produced obstruction by compression,

the foreign material was extruded from the joint and ankylosis returned.

In 1907, Weglowski⁹ transplanted with success the cartilage of a rib in a case of ankylosis of the elbow Chulmsky,¹⁰ in 1902, tried to use decalcified bone, magnesium and ivory but they all became absorbed and ankylosis returned He deduced, however, that as false joints or pseudarthroses in ununited fracture of long bones were formed of aponeurosis and fatty tissue, the same tissues could be used in the formation of a new joint in a case of ankylosis In the same year Nelaton¹¹ operated upon two cases of ankylosis of the hip-joint by interposing a strip of fascia lata between the head of the femur and the acetabulum In 1905, Murphy¹² reported twelve cases in which he interposed fascia and muscle covered with a layer of adipose tissue to produce, to quote him, "Normal movable joints with capsules and collagen intra-articular fluid" By this method hygroma-bursa formation is sought The formation of hygroma being "the result of a degenerative or absorptive process in fatty tissues with hyperplasia of the connective tissue element, the segmentation of the collagen into solution, 'fibrinoid', a liquefaction of hypertrophied connective tissue" His first operation of this character was performed in 1901 In 1909, Baer¹³ made a preliminary report on the use of animal membrane in securing mobility in ankylosed joints He used pig's bladder "which is chromicized so as to remain intact about forty days" The pig's bladder is boiled in cumol Osgood has reported several successful cases operated upon by this method Baer also used Cargile membrane or the peritoneum of an ox as the interposing agent but found that it was absorbed in a period of ten to fifteen days and therefore not useful This method of using animal membrane had been attempted before by Foderl, who, in experimenting on animals, interposed between the bones pieces of bladder and also the wall of ovarian cysts

This is but a partial list of those who have contributed to the development of the operation

When should operation be performed in a case of ankylosis?

For practical purposes ankyloses may be divided into two main divisions: the false, periarticular or extra-articular, and the true, articular or intra-articular Murphy sub-divides the periarticular into capsular and extracapsular, and the articular into synovial, fibrous, cartilaginous and osseous

The main treatment should, of course, be preventive, that is, one should attempt to guard against ankylosis of a joint which has been the site of an infectious or traumatic arthritis There are exceptions, however, even to this rule, as in tubercu-

ARTHROPLASTY.

BY HUBLEY R. OWEN, M D.,

OF PHILADELPHIA, PA ,

Surgeon to the Philadelphia General Hospital, Assistant Surgeon to the Orthopædic and Stetson Hospitals

It may be laid down as axiomatic that, where there are many cures for an evil or various remedies for a disease none is entirely satisfactory. Many standard operations, so to speak, are well nigh perfected, but a special method of operation for the relief of ankylosed joints has not been universally agreed upon. Failures as well as good results in such cases should be reported, as by such a course alone will we be able to reach a sound conclusion. Various methods have been used in attempting to mobilize ankylosed joints, and it is interesting to note the development of the operation.

In 1826, J. Rhea Barton¹ of this city performed an osteotomy for an angular true ankylosis of the hip-joint. He divided the bone through the great trochanter and a part of the neck of the femur, then prevented bony union by movements. In 1830, Rodgers² of New York modified Barton's operation by removing a disc of bone from between the trochanters, and in 1840, Carnochan³ attempted to prevent bony union after he had accidentally fractured the maxilla while operating for ankylosis. He interposed a piece of wood between the bony surface. In 1860, Verneuil⁴ interposed a piece of temporal muscle and fascia between the condyle and the glenoid in a case of ankylosis of the jaw. Twenty years ago, Helferich⁵ performed a similar operation on a child one year old, and after resecting the condyle of the inferior maxilla inserted a flap from the temporal muscle between the articulating bones. Since that time, this operation has undergone various modifications. In 1895, Mikulicz⁶ used practically Helferich's procedure but employed a flap from the masseter instead of from the temporal. In 1901, Cramer⁷ operated upon ten cases of ankylosis of the patella by the interposition of a piece of vastus internus, of these ten cases six were successful. Orlow⁸ in the same year attempted the use of metal plates and gold foil as the intermediate body and this procedure was followed by the use of other non-absorbable materials such as plates of celluloid, zinc, silver, cambric, collodion and rubber.

With these agents an occasional good result was obtained, but in the great majority of cases a few months after operation

which carry the weight of the body, hygroma formation is necessary or at least desirable and Murphy's operation leads to a hygroma or formation of a new bursa. On the other hand, in the elbow, shoulder and the mandible a wide range of mobility is desired, there is no weight born by the joint and it would therefore seem that the formation of hygroma is not essential, therefore, the use of Baer's membrane is the preferable material for interposition. The technic of the interposition of this membrane is considerably easier than the technic of the Murphy operation.

In the hip-joint any position of ankylosis must be not only an inconvenience but an actual interference with one's ability to earn a livelihood. It should, therefore, offer a good field for arthroplasty. The same may be said of ankylosis of the shoulder.

In ankylosis of the knee and elbow, however, it would seem in the light of our present knowledge and experience that one should not too hastily fly to operation.

Even according to Murphy's own statistics the elbow and the knee offer the poorest prognosis of any joints. Therefore, if a patient has intra-articular ankylosis of a knee-joint, the ankylosis being with the leg in extension, there being no pain and the man or woman being able to perform his or her occupation, it would not seem that arthroplasty should be attempted without a full explanation to the patient of the facts that the operation will be followed by considerable pain, and that, whereas some motion may be obtained, it may be slight and ankylosis may recur.

The same might be said of the elbow. If there is ankylosis of elbow with the forearm at right angles to the arm, and if, in spite of the ankylosis the patient is able to earn a livelihood and the extremity is not painful the pros and cons should be carefully weighed before deciding on operation.

On the other hand, given a knee ankylosed at or near a right angle, or an elbow ankylosed in extension, positions which must of necessity be a great handicap, then it would seem that operation is entirely justifiable. Preferably arthroplasty should be

lous affections of joints ankylosis is often most desirable. In such cases or in cases where ankylosis is inevitable the aim should be to obtain a position which will render the part most useful. Baking, massage, passive movements, brisement forcé with an anæsthetic, tenotomy, myotomy, tendoplasty or myoplasty, excision of tendon sheaths, or cicatrices, are all methods employed in relief of periarticular, extra-articular, or false ankylosis.

Should some form of open operation be attempted in intra-articular ankylosis? This naturally must depend upon the cause of the ankylosis, the joint affected and the present usefulness of the part. One hesitates to open a joint which has been the site of a tuberculous infection, because, although the infection may apparently be dormant, operation and the subsequent passive movements may cause the infection to take on renewed activity. Many such cases have, however, been successfully operated upon, among which is the case to be shown to-night. The X-ray is of course valuable, but not absolutely final, in showing if the infection is still active. Hesitancy is unnecessary if the ankylosis is due to trauma such as fracture or to infections such as rheumatism, gonorrhœa, etc.

The mandibular joint offers the best field for operation. First, because of the favorable prognosis, second, because of the immense importance to the individual of mobility in this joint. Fortunately ankylosis of this joint, which follows severe forms of stomatitis and noma, is usually extra-articular and mobility can be usually obtained by relieving the periarticular cicatrices. When ankylosis is intra-articular arthroplasty can be performed and either a flap from the temporal or masseter muscle or chromic pig's bladder can be used for the formation of a new joint. The latter has been successfully used by Brackett¹⁴.

From the reports of cases in literature it would seem that the future use of these interposing tissues may depend upon the joint involved. It would seem possible that the Murphy operation will continue to be used in the knee-joint and in the hip-joint. In these joints, which are joints of locomotion, and

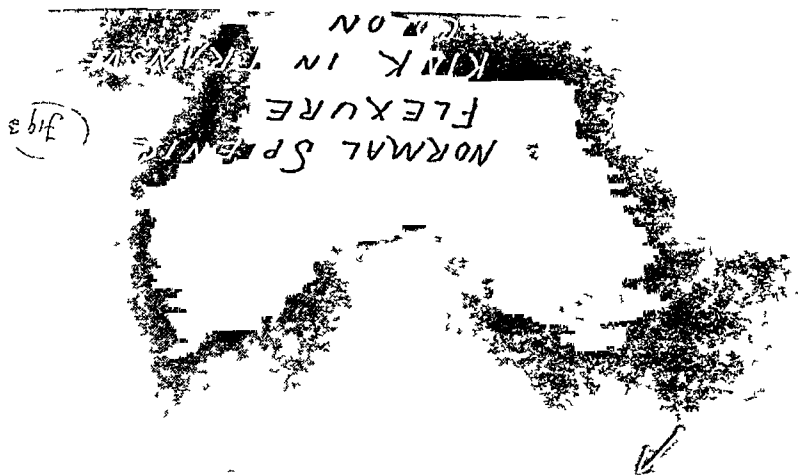


Fig 3

attempted, for, even if unsuccessful as to mobility, a better position can be obtained for possible subsequent ankylosis

Illustrative Case—A boy, now thirteen years old, was admitted to the Orthopædic Hospital on October 11, 1912, in the service of Dr William J Taylor. The history was that of a tubercular arthritis of the right knee. Several operations had been performed merely for draining the joint. The condition of the knee was that of ankylosis of tibia, fibula and patella. The knee-joint was ankylosed at an angle of 45 degrees. There was no pain, no inflammation, no fever, all sinuses were healed.

Operation was performed by Dr Taylor, November 8, 1912. A U-shaped flap was made with convexity downward. The skin flap was turned upward. The patella was sawn obliquely from above downward, and the joint was opened. All adhesions between the tibia and femur were freely liberated, the surface of the tibia and surfaces of the condyles cleaned of fibrous tissue and the capsule was cut away. By means of curved and straight chisels new and fresh surfaces were made. Sufficient bone must be chiselled away to allow for the interposing flaps and yet too much bone must not be removed for fear of obtaining a movable but weak joint.

Murphy has pointed out the necessity of keeping the intercondylloid ridge on the tibia intact to prevent lateral slipping of the femur.

The two interposing flaps were then cut, one from the external side, the other from the internal. They were interposed between the bones and sutured with No 3 chromic gut. Because of the inability to get a good surface on the under aspect of the patella, it was turned over so that the normal anterior aspect became the posterior aspect. The wound was closed without drainage and the limb placed in a plaster case. This case was not removed for four weeks and no passive nor active movements were made until that time.

He was discharged from the hospital ten weeks after admission. He wore a supporting brace steadily for 6 months, then intermittently until end of a year.

REFERENCES

- North Amer Med and Surg Journ, 1827, p 290
ited by Murphy, J A M A, May, 1905
urphy (*ibid*)

FIG 1



Result of arthroplasty on an ankylosed knee-joint Flexion after operation

PARALYTIC TOE-DROP. PUTTI'S OPERATION FOR ITS RELIEF.'

WITH REPORT OF A CASE AND SLIGHT MODIFICATION OF THE TECHNIC

BY J TORRANCE RUGH, M D,
OF PHILADELPHIA, PA

IN a survey of the deforming results of anterior poliomyelitis so far as the various joints are concerned, probably the most difficult of mechanical control is the hip-joint and next to it may be placed the ankle-joint, because of the range of movements of the foot when deprived of muscle control. Whether the loss of power be confined to the anterior group of muscles, or to the posterior group, or to both, the resulting deformity presents in many instances, a problem difficult of solution either mechanically or surgically. The multiplicity of forms of braces and the varieties of operations employed from time to time are the best evidence of the inefficiency of any one, and the constant effort of orthopædic surgeons has been to devise a means of correction which should prove reliable and permanent.

It must not for a moment be considered that every case of toe-drop or of calcaneus or of flail-foot following an attack of infantile paralysis is a proper one for operation, for it is not. Many paralyzed muscles recover power years after the attack, when the strain of position or function is removed from them, and the earliest and most essential factor in the treatment of these cases of paralysis is to put the parts at rest and remove strain from the weakened and inert muscles. This will favor the subsidence of inflammation in the motor cells of the cord, will check or lessen degeneration in these cells, will prevent the onset of deformity and the stretching of structures, and will also frequently be followed by return of power in muscles thought to be dead. After about six years have passed, how-

* Read before the Philadelphia Academy of Surgery, December 1, 1913

- ⁴ Archives de Medicine, 1860, p 284
- ⁵ Cited by Murphy
- ⁶ Cited by Baer, Amer Jour Orthorp Surg, August, 1909
- ⁷ Paper read before the 30th congress of the Deutsche Gesellschaft Chir
Berlin, April 13, 1901
- ⁸ Cited by Baer, *ibid*
- ⁹ Centrablatt fur Chirurgie, April 27, 1907
- ¹⁰ Centrab f Chir, September 15, 1900
- ¹¹ Bull et Mem de la Soc de Chirurg, 1902
- ¹² Jour A M A, May, 1905
- ¹³ Amer Jour Orthorp Surg, August, 1909
- ¹⁴ Papers from the Orthop Dept of Mass General Hosp, May, 1912

Gallie, the results are sure and certain, as the tendons are converted into ligaments and do not stretch

In the third group, Robert Jones has had good results from the resection of a portion of skin and fascia on the elongated side and bringing the edges together to maintain correction. This procedure when used in conjunction with tendon work affords reinforcement and lessens strain.

The fourth group has been extensively employed and is to be very strongly recommended. The results of the inserts of paraffined silk appear to be permanent, whether the parts reinforced be tendon or ligament. The only criticism to be offered against it is that silk is a foreign body, and if the same results can be secured by the use of living structures which are already in position and which are unyielding, I believe the local tissues should be utilized even though it is urged that the silk inserts rarely cause trouble by suppuration or otherwise.

In August, 1913, Dr V. Putti, of the University of Bologna, Italy, performed for the writer another method of fixing these permanently paralyzed tendons which he has been using for some time with excellent results. The underlying principle is the same as that used by Sangiorgi (quoted by Gallie) and Gallie, viz. to convert the tendons of the paralyzed muscles into ligaments, but Putti eliminates absolutely the degenerated muscle tissues which are the structures that stretch and permit the recurrence of the deformity and in this respect renders results more certain.

The operation for toe-drop with paralysis of the tibialis anticus, dorsal flexors of the toes and the peroneus tertius as done by Putti is as follows:

The tendo achillis is first made long enough (if not already so) to allow a right-angled position of the foot. An incision four or five inches long is then made from above the ankle-joint upward along the tibial crest and the anterior tendons exposed. These are separated and all are severed from their muscle attachments as high up as possible. The tibia is then freed about the middle of this incision and an oblong hole of sufficient size to receive all the tendon ends is mortised through it. The periosteum is next lifted from the front surface to the tibia. A tendon end is passed through the hole from one side and drawn taut, the foot being held at a right angle. Another tendon is next passed through from the other side

ever, with careful supervision as to muscle strain, with massage and other local means to aid restoration of function, if paralysis still persists in a muscle or group of muscles, it is quite proper to consider this the real, permanent or residual paralysis and to institute surgical measures which will preserve the normal balance of the part for the performance of its functions in the best possible manner. Without such means, the patient is doomed to a life of brace-wearing which is always troublesome and at times extremely disabling through breaking of the appliance and inability to have prompt repairs made.

The surgical correction of paralytic conditions of the foot may conveniently be considered under four divisions (1) Operations upon the bony parts, (2) operations upon the tendons and muscles, (3) operations upon the skin, and (4) operation by silk inserts in tendons or ligaments.

Under the first group is included arthrodesis of the ankle, transtarsal or tarsal joints. These operations have proven only partially successful. Great difficulty is experienced at times in securing firm ankylosis and where this does obtain, the part oftentimes proves painful for walking and the gait is a stilted one.

The second group received earliest consideration through the work of Nicoladoni, who in 1881 first practised transplantation of live tendons to assist or replace the paralyzed ones, and this was the first really great impetus to the surgery of paralysis. Many varied types of operation have been suggested and performed on these structures since then, such as shortening by tucking, by cutting out a section, by changing the point of insertion and by changing the angle of pull, by passing the tendon through a subperiosteal groove and fixing it there (Dr W. E. Gallie, Toronto, Can., *ANNALS OF SURG.*, March, 1913, and *Amer Jour Orth Surg.*, July, 1913). In all of these methods, the immediate results are good but in all excepting where the tendon of a live muscle is transplanted and where it is fixed in a subperiosteal groove, the deformity is extremely likely to recur, because the structures which stretch, viz. the degenerated and paralyzed muscles, are still subjected to strain. Where they are eliminated as in the procedure reported by

with dorsal dislocation of the toes upon the metatarsal ends To obviate this, I propose to engraft the tendons of the dorsal flexors into the distal end of the metatarsals, either by severing them well forward and drawing the end through a hole drilled in that part of the metatarsal, or by lifting a flap of periosteum and cutting a groove on the dorsal surface of the bone, laying the tendon in this groove and securing it by suturing the periosteal flap over and to it (as described by Gallie and Sangiorgi)¹ A bone-flap could also be used if desired, but I believe one of the others will be sufficient to focus the ligamentous pull on the distal end of the metatarsals and obviate the threatening deformity of the toes

This procedure is simply a combination of two mentioned operations but it will, I believe, provide the solution of the treatment of this most troublesome condition Putti's method of fixing the tendons in the bones of the leg is safe and sure and of course can be applied to any type of paralytic deformity about the foot, such as calcaneus (using the tendo achillis and plantar flexors of the toes or the tibialis posticus or the peronei), valgus (using the tibialis anticus or posticus or both), or varus (using any or all of the peronei)

¹ This operation was completed as above outlined on December 12, 1913, with very satisfactory immediate results and there is every reason to feel that the ultimate results will be as desired as this additional work has been thoroughly tried out by many operators and has received the stamp of approval

and the remaining tendons alternately until all are threaded. The ends are next drawn under the raised periosteum and firmly stitched in place to tendons, periosteum and tendon ends (Putti uses silk-worm gut sutures for this and leaves them buried) and the wound is closed. The parts are fixed for a couple of weeks by a splint, but Putti expresses himself as favorable to treatment without any support, believing that union will be much more firm if a little strain is permitted on the operated tendons and that we weaken the attachments by long continued fixation.

The mechanical features of the operation are entirely correct in the elimination of the weak and easily stretched muscle structures and conversion of the tendons (which stretch but little when continuous) into a large strong ligament having a sufficiently long hold on the foot and leg to give firm fixation and withstand quite a degree of strain. On November 21, 1913, I operated by this method upon a boy, S. M. (patient shown to the Academy), aged thirteen years, who had an attack of infantile paralysis over eleven years ago. There was complete loss of all the anterior muscles of the leg and foot with slight power in the plantar flexors of the toes and in the tendo achillis. There is also good power in the hamstrings, very slight power in the rectus femoris, and flexion of the knee to 15° .

After fixing the proximal ends of the severed tendons, as above described, the foot was maintained perfectly in the right-angled position and a plaster splint was applied to the entire leg, the knee being first forcibly straightened preparatory to a transplantation of the external hamstring into the patella.

In one feature, however, the operation impressed me as lacking and I shall correct this at the subsequent operation on this case. When the dorsal flexors are drawn taut, the toes stand out straight and would probably remain so if the plantar flexors were also paralyzed, but with these muscles alive and in action during function of the foot, it will be but a short while until the toes will become flexed through dropping downward of the metatarsophalangeal joints (from stretching of the fibres holding the dorsal flexor tendons to the top of the metatarsals and proximal phalanges), and the flexion of the distal phalanges of the toes and a condition of hammer-toe will be established.

and gave him a perfectly useful and serviceable arm, so much so that he declined to have the other one operated upon, saying that he could get along with the one Dr Taylor had resected the shoulder-joint many times and the results are so satisfactory that this is the operation of choice, rather than arthroplasty

DR J T RUGH called attention to the method of arthroplasty originated by Dr R T Taylor, of Baltimore, which consists in the shaping of the joint surfaces by the removal of a sufficient amount of bony material to allow free function, and then filling the joint cavity with a preparation of wax which has a rather high melting-point The joint is then closed and movements are begun at the end of a week or ten days He had seen some remarkable results in these cases from that procedure It is comparatively easy of performance, the most difficult part being the removal of the joint surfaces

DR ASTLEY P C ASHHURST said that it seemed to him that a more important matter than the mere question of technic is the indication for the operation He regretted very much that Dr Owen cannot say whether or not this was really a tuberculous case If he has made a tuberculous knee-joint movable with safety he would be accomplishing a great surgical feat Dr Ashhurst was one of those who believe arthroplasty to be contra-indicated in cases of tuberculous ankylosis It is interesting to recall that Dr John B Murphy attempted arthroplasty on an ankylosed hip that was undoubtedly tuberculous, found an unsuspected abscess, and left the man, at last reports, with discharging sinuses

Dr Owen spoke with proper caution about the indications for arthroplasty, and though the patient he shows has a good motion (120 to 150 degrees), it would seem that in a child of twelve years supposed to have a tuberculous ankylosis in bad position, it would have been safer on general principles to have taken out a wedge of bone and thus made the knee-joint stiff and straight

DR GWILYM G DAVIS thought that in spite of the successful result in this case the introduction of drainage is decidedly of service as a precautionary measure On two or three occasions he had not used drainage and had always regretted it, by this he meant drainage for 24 to 48 hours

Apropos of the tuberculosis question, he operated once on a tuberculous knee, and while he got some motion he did not get as much as he desired and the knee remained painful for a long, long time, and he had been inclined to be conservative since then

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, held December 1, 1913

DR GWILYM G DAVIS, the President, in the Chair

ARTHROPLASTY OF THE KNEE-JOINT

DR HUBLEY R OWEN presented a paper on Arthroplasty of the Knee-Joint, for which see page 426 An illustrative case was also presented

DR WILLIAM J TAYLOR said that in this case there had been suppuration, the patella was worm-eaten on the under surface, and fixed to the articulating surface of the femur, so that in order to get movement it was necessary to turn it upside-down Flaps of fascia and fat were made, taking them from above, bringing them down between the articulating surfaces, and as they were not quite long enough to go clear through they were lapped over about one-third and stitched The boy has a better joint than had been hoped for The patella was sawed through obliquely in order to get the largest possible surface, and each half turned upside-down, the sawn surfaces twisted in the opposite direction, then brought together again and united by catgut sutures This made a perfectly good, strong, bony union, with the result that the patella is now perfectly movable

In this case the condition of the bone was such and the angle was such that it was necessary to take off quite a considerable amount of bone, particularly from the end of the femur, to get the leg straight It is essential to take off enough of the surfaces to make the apposition between the ends of the two bones comparatively easy

As to the question of the other joints, some years ago he had a man under his care in whom both elbows were absolutely stiff, due to an infection from his tonsils He resected his left elbow

In relation to the elbow-joint it is one of the most satisfactory joints for arthroplasty as well as for resection, and the results from arthroplasty are so far more brilliant than are obtained by resection

PARALYTIC TOE-DROP

DR J TORRANCE RUGH read a paper on Putti's Operation for Paralytic Toe-Drop, for which see page 432

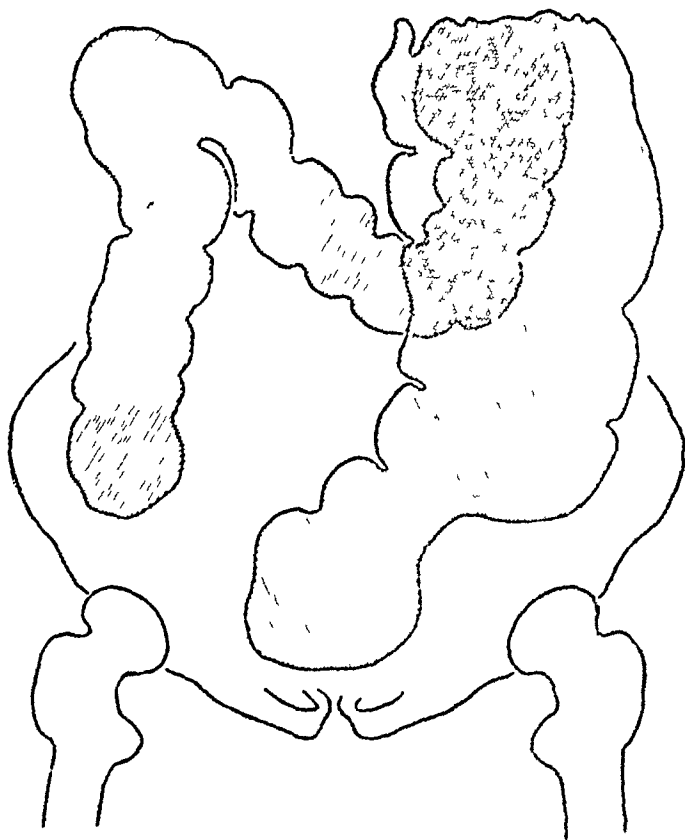
DR A B GILL (by invitation) said that he had observed four cases in which silk ligaments have been implanted to correct paralytic foot-drop. The ligaments are put through a hole drilled through the tarsus and then passed up the leg within the sheaths of the peroneus tertius and the tibialis anticus, and then passed through a hole drilled through the crest of the tibia and fastened there. Of the four cases, one is now of two years' standing, in which the silk is still holding the foot in good position with marked improvement in the gait. One silk ligament of the four broke, owing to weakening of the silk by too prolonged boiling in the bichloride of mercury. It was an easy matter to replace the silk. The other cases are in good condition. There has been no condition of flexion of the toes resulting from the operation. It will be interesting to observe in the Putti operation when the tendon is severed above and below whether there will occur degeneration and stretching of the tendon.

DR GEORGE ERETY SHOEMAKER expressed surprise at the use of buried silkworm gut sutures. This is a substance which was tried out very thoroughly years ago in this country and abandoned as a buried suture material, because it was absolutely unattacked by the cells of the body and always remained as a foreign body during the lifetime of the patient. A permanent suture does no more good than a temporary one, as under the slightest tension it cuts until it does no more holding. He had had occasion to take out a considerable number of silkworm gut sutures put in under perfectly sterile conditions, the sterility persisting for say two years, when the sutures would begin slowly to work their way out. He had buried many hundred worm gut sutures in aponeurotic tissue, and had seen probably one per cent give trouble after long intervals.

DR J TORRANCE RUGH (in closing) said that he had mentioned the fact that Professor Putti used the silkworm gut, though he himself did not. He called his attention to its abandonment

Cases in which the great omentum forms a covering to the underlying colon have been described by L S Pilcher and J. N. Jackson, and have been observed in the foetus by one of the writers (J. R. Eastman, *Surgery, Gynecology and Obstetrics*, May, 1913) and Douglas G Reid, of the University of Cambridge (*Journal of Anatomy and Physiology*, October, 1912) In Pilcher's case the result of the presence

FIG 2



Descending colon filled with enema of barium sulphate, arrested at splenic flex.

of peritoneal sheets and bands thus formed was to sharply angulate the colon at the hepatic flexure and to bring parallel to each other the ascending colon and the first part of the transverse colon, causing them to lie side by side like the two barrels of a double-barrelled shotgun (*ANNALS OF SURGERY*, January, 1912)

In our case of pericolicitis sinistra a somewhat similar state of affairs existed upon the opposite side, as indicated by Figs. 1 and 2 However, that the last part of the transverse colon

upon itself one complete turn. The bowel was very dark in color but the peritoneal coat lustrous, and after irrigating with hot normal salt solution, the color of the bowel improved and the circulation returned in the mesenteric vessels. The constriction was found at the internal ring and after dividing it the bowel was returned to the abdominal cavity. The aponeurosis of the external oblique and the internal oblique muscle were then sutured to Poupart's ligament with chromicized catgut, thus depressing the cord. The skin wound was closed with three silkworm gut sutures. At the close of the operation the infant vomited fecal matter and this was the first vomiting of which we had any knowledge.

The child nursed the following morning and this day there was a normal bowel movement. The convalescence was uneventful and the child was discharged with a firm wound on the twenty-first day.

Dr. Lee called attention to the satisfactory anæsthesia obtained by the local infiltration of a solution of eucaine. The anæsthesia seemed perfect during the entire operation, the infant busily sucking the thumb of the nurse.

RADICAL OPERATION FOR A HERNIA OF THE UMBILICAL CORD IN A NEW BORN INFANT

DR. WALTER E. LEE reported the history of an infant who was brought to the dispensary of the Children's Hospital one hour after its birth. Dr. Edward B. Hodge saw the child and advised immediate operation. It was by his courtesy that the reporter operated and had the privilege of reporting the case.

The infant seemed perfectly formed except for a large cystic tumor which protruded from the anterior abdominal wall. The tumor was nearly as large as the infant's body. The circular opening in the abdominal wall, an enlarged umbilical ring, extended from the xiphoid cartilage to within one inch of the pubic bone. The skin of the abdomen was continued upon the pedicle of the sack for one-quarter of an inch, where it ended as a sharp border beyond which a transparent membrane as thin as paper covered the remaining portion of the tumor as far as its distal extremity, where the covering was drawn out like a funnel and became continuous with the ligated umbilical cord. The umbilical vessels could be felt as a cord on the lower surface of the tumor. The liver, the spleen and the large and small bowel could be clearly seen through the hernial covering floating in a clear transparent

in America and he said he never had any trouble whatsoever from it. He had used it for a number of years and he claimed most excellent results. Dr. Rugh used chromicized catgut in this case as he does in all.

In regard to the silk ligaments, he was a firm believer in their use, but anything of that kind is a foreign substance, and if you have structures which are capable of preserving the position of the foot, why introduce a foreign substance? He had done quite a number of these cases of silk ligaments for this condition of toe-drop, for valgus and for varus and had had no trouble since using the paraffin silk, but he did have trouble with bichloride silk, as it came out by sterile suppuration. The paraffin silk remains in and is very good. But here are structures which are inelastic, and already in place and if you fix them you make ligaments out of the tendons. If any change takes place, even if they lose their identity as tendons, they are still ligaments.

This operation has been done for a couple of years by Putti, who claims that they were holding splendidly, and unless the tendons should stretch, it is the ideal operation for this condition.

RADICAL CURE OF AN INCARCERATED INGUINAL HERNIA IN AN INFANT TWENTY DAYS OLD

DR. WALTER E. LEE reported the history of an infant who was admitted, January 20, 1912, to the service of Dr. James P. Hutchinson at the Children's Hospital.

It was by the courtesy of Dr. Hutchinson that the reporter operated upon the child and had the privilege of reporting the case.

Upon admission the right half of the scrotum was found enlarged and tense and the tumor emerged from the external inguinal ring. The scrotum became normal in size after taxis when a gauze pad over the external ring with adhesive plaster and spica bandage reinforcements were applied to secure the reduction. Following this the child had three normal bowel movements and seemed perfectly comfortable for twenty-four hours when the tumor reappeared and operation was decided upon.

The skin and subcutaneous tissues were anesthetized by infiltration with thirty minims of a four per cent solution of eucaine. On opening the sack about one drachm of bloody fluid escaped. One large loop of small intestine, ten inches in length, with its mesentery were found in the sack and the mesentery was twisted

Owing to the impoverished circulation of the limb, the operative wound remained indolent for several weeks, but was eventually stimulated to heal by the application of Bier's powder of nitrate of silver and powdered clay

A month after operation the patient complained of pain in the distribution of the anterior tibial nerve to the adjacent sides of the great and of the second toes. This nerve was reached in the first interosseous space by a hypodermic needle, and was blocked with alcohol. This sufficed to relieve the pain.

DR MORRIS BOOTH MILLER said that he had had some experience with Buerger's disease and had been very much interested in Dr Skillern's account of the relief of pain by the severance of the musculocutaneous nerve. These cases are most distressing, the patients suffering at all times, especially during cold weather. He was surprised at so much benefit having resulted from cutting a single nerve, his observations would have made him believe that the severance of the whole nerve trunk would be necessary. Within the last ten days he had seen another complication which may occur, a man upon whom he had operated at different periods for Buerger's disease was stricken with a cerebral embolus. The diseased condition is one of vascular change involving all parts of the blood-vessels, both arteries and veins, and of the structures outside of the vessels, thereby affecting the nerves. This process is not a continuous one, it seems to show periods of rest, when the patient will be nearly free from pain though showing distinct objective symptoms, and then there will be an increase of all symptoms corresponding to new and further vascular change. In the case mentioned of cerebral embolus the man had just suffered an augmentation of this phenomenon.

DR DUNCAN L. DESPARD said that he had had an opportunity of operating on a number of these cases and then following them by microscopic examination of the vessels. In regard to the cause of the condition he had been struck by the proliferation in the intima and the elastic tissue which takes place in these vessels and frequently without obliteration of the lumen of the artery. He did not think that the obliteration by a thrombus is entirely to be accepted as the cause. He had a case last summer, of a man who suffered greatly. Since June applications of X-rays, two or three times a week, had been made. As a result he has obtained a great deal of relief from his pain. It has passed entirely from his toes and legs and he now complains of pain in the region of the

fluid These organs were all outside of the margin of the umbilical ring

The child was anæsthetized with ether and an attempt made to reduce the organs This was unsuccessful and upon opening the sack, the bowel, liver and spleen were found adherent to the sack wall in many places After ligating the umbilical vessels and breaking the adhesions the bowel and spleen were reduced, but it was necessary to enlarge the opening in the abdominal wall by an incision toward the pubes before it could be replaced The hernial sack was excised and the abdominal wall united with ten chromicized catgut sutures which passed through the entire thickness of the wall The tension upon these sutures was relieved with strips of Z O adhesive encircling the abdomen The increased intra-abdominal pressure resulted in a large amount of meconium being expelled at the end of the operation The child lived for five days During this time the bowel moved three to four times daily and it regurgitated small amounts of mucus flecked with black particles which looked like meconium It was fed with a weak mixture of condensed milk and an attempt was made to bring some of the mother's milk to the hospital on the fourth day but the plans miscarried

No autopsy was obtained and the cause of death remains uncertain

Dr Lee added that congenital herniæ of the umbilical cord should be classified as malformations since the peritoneum and viscera are not abnormally protruded but lie in front of the anterior abdominal wall as in the early stage of intra-uterine life, the normal closure failing to take place It is really an ectopia

The outer covering of the sack is formed by the distended tissues of the umbilical cord, a thin layer of the jelly of Wharton, and behind this is the hernial sack, corresponding in its position to the peritoneum and continuous with the abdominal peritoneum

As the circulation in the umbilical cord ceases immediately after birth the stump of the cord becomes necrotic, shrinks up and is cast off after several days, the covering of the hernia of an umbilical cord naturally undergoes the same fate, exposing the abdominal viscera, the consequent suppurative peritonitis usually causing death

Radical operation was first advocated by Lindfors in 1881 Hansson published a collection of 73 cases treated in the antiseptic method, 1900 Mortality of 32.8 per cent

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of the toes, usually the big toe, and frequently under the nail, and when this condition ensues the local pain becomes intense. Even before the gangrene, at the ulcerative stage, amputation may become imperative because of the intensity of the pain.

The following case illustrates with great fidelity most of the features described by Buerger.

M. L., male, Hebrew, aged forty-two, sheet-metal worker, presented at the Surgical Out-patient Department of the University Hospital, service of Dr. B. A. Thomas, July 17, 1913, complaining of intense pains in both legs of a year's duration. The pain in the left leg is greater, and is constant, night and day. It is chiefly burning in character.

Examination revealed both feet involved in ischæmia, obliteration of pulse or dorsalis pedis on both sides, and a dusky blush involving both great toes. A trophic ulcer beneath the nail of the left great toe exposes the end of the ungual phalanx.

Nerve-stretching had been performed in another city without relief, and everywhere the patient went amputation was advised as the only method of relief from the wearing pain. Examination of the distribution of the pain showed that it was confined chiefly to the area presided over by the cutaneous filaments of the musculocutaneous nerve. It was figured out that if this nerve were resected, amputation could be postponed indefinitely, and the patient allowed to retain the otherwise useful limb—at least until extensive development of gangrene indicated amputation. Accordingly, using a solution of novocaine two per cent, with adrenalin 1 to 3000, intradermic infiltration along a transverse line 2 inches broad with centre over antero-external border of fibula, was made 4 inches above the base of the fibular malleolus. The cutaneous division of the musculocutaneous nerve was exposed at its emergence from the deep fascia, and a section one inch long was excised. The relief from the burning pain was *immediate*. The wound was drained by a folded strand of silkworm gut. It was closed by 4 silkworm gut sutures, and a dilute alcohol dressing applied.

The day after operation there was no pain in the foot. Reports upon the blood and the urine, which had been previously collected, showed that the Wassermann reaction was negative and that there was no sugar. The patient was given 5 drops of a saturated solution of the iodide of soda and one hundredth of a grain of nitroglycerin three times a day after meals.

sels are concerned, possibly Dr Mitchell was correct, when many years ago he suggested the spinal cord as primarily the seat of the trouble, since theoretically stimulation of the sympathetic motor neurons of the cord will produce marked peripheral vasomotor constriction of the blood-vessels

The relationship of this condition largely confined to a single class of people may be explained upon the basis which Dr Crile has enunciated in his theories underlying the production of shock. This disease is found in a highly emotional class, subject to tachycardia, and neuroses of every description, and who suffer post-operative shock to a greater degree than any other class of patients. They are more subject to sensory stimulus, and therefore react to a greater corresponding degree, hence the great variations in blood-pressures observed in the same patients at different times. It would seem that an important predisposing factor in the production of this condition is something in the physiological make-up of these patients, not any previous article of diet, but perhaps an unusual sensitiveness of their cerebral or spinal motor neurons acting upon the blood-vessel wall.

DR PENN G SKILLERN (in closing) said that in regard to the entire relief from pain in this case it might be explained by the pain being confined to the distribution of the cutaneous division of the musculocutaneous nerve. The process described by Buerger involves the intima, the media, and the adventitia together with the perivascular tissues, one huge cicatricial mass from the lumen out to the muscles. The veins are equally involved and that is why any attempt at arteriovenous anastomosis fails. This condition is not to be confused with Raynaud's disease, which is a *functional* disturbance. The kinetic theory of Crile, suggested by Dr Ginsburg, does not explain in any way this cicatricial mass of blood-vessels. The cause is most likely a toxæmia somewhere in the body, and the predilection of the disease for the vessels of the lower extremity is determined by the static strain to which they are constantly subjected.

EPIPHYSEAL-METAPHYSEAL FRACTURES

DR. PENN G SKILLERN, JR, called attention under the above heading to partial fracture of an epiphysis or of the adjacent portion of the shaft, latterly designated the metaphysis. This injury is not to be confused with the well-known epiphyseal injuries that

knees, which have not been subjected to the X-rays Strange to say, the temperature of the legs has increased They were cold during the summer and the other day there was a perceptible increase in the local temperature to the hand Whether he will have continued relief or that this is simply a temporary improvement, remains to be seen

DR GEORGE P MULLER said that he had seen a great many of these cases, mostly in Dr Frazier's Clinic in the University Hospital A number of years ago the affection seemed to be limited to the great toe, and was commonly known as Mitchell's disease, but in recent years they have observed more cases in which the entire foot or even the leg was involved He did not know that they had obtained any permanent relief by any method of treatment short of amputation They have stretched, injected, and cut the internal saphenous or external cutaneous nerves, and have had X-ray treatment used, and high frequency current, etc In two cases he performed arteriovenous anastomosis and in another he tried to do so but found the femoral artery a solid cord He was not an advocate of this method of treatment and cannot agree with the enthusiastic claims of Wieting, Bernheim, and others They have resorted in at least two cases to amputation These amputated limbs were examined in Dr Speese's Laboratory and there was distinct evidence of thickening of the femoral vessels and more or less thrombosis in the veins

DR NATHANIEL GINSBURG (by invitation) said that for some time he had been interested in this subject, because of the almost sole limitation of this affection to a single race—the Jews

Continued observation of young Russians, who have recently come to this country, with the idea of determining whether it is a purely peripheral condition, has convinced him that this disease possesses a symptom complex of which the peripheral state is only a part As an example, he has been observing now for the past five years a young man of about twenty-four years of age, who presents marked disturbance of the circulation in his hands and feet Examination of his surface blood-vessels reveals very feeble pulsation in his brachials, axillary and femoral arteries, indicating a general vasomotor constriction of all these blood-vessels The maximum effect is first felt in the digits of both upper and lower extremities, which become the seat of trophic changes, very often necessitating amputation of the part While Buerger has established the pathology of this condition as far as the peripheral ves-

and the beginning of the descending colon should be held together in the double-barrelled relation is not remarkable in view of the circumstance that the splenic angle is, under normal conditions, an acute angle as shown in Fig 3, and not one of 90 degrees as might carelessly be assumed. If there be ptosis of the transverse colon the angulation at the so-called splenic flexure may be quite sharp, for the phrenocolic ligament of Toldt is so firm as to preclude the splenic flexure from participation in the ptosis. If the phrenocolic ligament be short and tense, splenic kink as described by Gray and Anderson (*The University Press, Aberdeen, Scotland, 1912*), sometimes called Payr's disease, may ensue. In our case the splenic angle was sharply constricted and fettered by pericolic membraniform adhesions and the transverse and descending limbs of the colon were held up sharply angulated by the phrenocolic ligament. It was, in all probability, this sharp angulation of the colon and the fettering by pericolic bands which retarded the flow of the barium sulphate through this colonic segment, and gave rise to the ballooning of the bowel previous to the slow passage of the barium column through the constricted splenic angle. It was noted also that there were, in addition to the left-sided pericolitis, numerous adhesions between the left margin of the omentum and the ascending colon, and that the vermiform appendix was buried beneath a pericolic membrane.

Since in the case here reported the membranous adhesions were, for the most part, not in the neighborhood of the caput coli or ascending colon, their origin cannot be ascribed to persisting fetal folds of Jonnesco and Juvara, or Treves or Douglas Reid. However, it is not altogether illogical to suspect such membranous adhesions, even upon the left side, of dating from the fetal period of life in view of the common appearance of such adhesions in the foetus. In Fig 4 is shown the extensive area of peritoneal adhesion between the stomach and transverse colon, as observed by Douglas Reid in the foetus. That extensive pericolic membranes of the left side are consequent upon adhesion formation before caecal

have been classified by Ollier as paraepiphyseal strains, paraepiphyseal sprains, and disjunction of epiphyses

Illustrative of partial epiphyseal fracture is the following case

M. E., male, aged four and a half years, while riding a bicycle was run into the curb by a coal wagon and fell off, injuring the right knee. Skiagram (Fig 1) shows the separation of a small unciform fragment from the tibial side of the lower epiphysis of the femur. Gypsum case was applied. This fragment shows equally well in lateral view (Fig 2). It will be noted that it was caused by *direct* violence, and therefore is not a true tear-fracture.

Illustrative of partial metaphyseal fracture is this case

W. G., male, aged five, fell off the porch, injuring the right elbow. Examination 4 days later revealed swelling, tenderness and lemon-yellow ecchymosis about the external condyle. Skiagram (Fig 3) showed partial fracture of the external corner of the lower metaphysis of the humerus, with but trifling displacement. The arm was dressed on an internal right-angle splint. This injury was also produced by direct violence.

In addition to these epiphyseal and metaphyseal fractures by direct violence, it is conceivable that tear-fractures of the metaphysis might arise from overstretching of a part of the articular capsule, or of one of its specially thickened bands, or ligaments. Tear-fractures of certain epiphyses, to which ligaments are attached, could also occur, in which event the epiphyseal bond of union is stronger than the ligamentous.

EXTENSIVE COMMINUTED FRACTURE OF THE LOWER THIRD OF A HUMERUS STUMP

DR. PENN. G. SKILLERN, JR., presented the following case more as a surgical curiosity than for any other reason.

C. W., male, aged thirty-three, clerk, fell backward, landing on the lower end of the stump of the left humerus. Clinical examination revealed swelling, preternatural mobility, crepitus and tenderness in the lower third of the humerus. Skiagram (Fig 4) revealed comminution of the shaft of the left humerus, just above the lower end, into a dozen small fragments, with vertical splitting of the shaft. This was dressed upon an anterior and a posterior splint.

Sixteen years previously disarticulation at the left elbow-joint was performed for a gunshot injury to the forearm. Two years ago he fell, and had a clean transverse fracture of the same stump.

Extensive comminuted fracture of lower third of humerus stump



Fig 4

Partial fracture of lower metaphysis of humerus

Partial fracture of lower epiphysis of femur Anteroposterior view

FIG 2

Partial fracture of lower epiphysis of femur Lateral view

recovery was normal, excepting for a discharge of liquid fat for a week or ten days and a slight attack of pleurisy during the second week of her convalescence

Dr Vosburgh presented a second case of ventral hernia in the person of a woman, thirty-four years old, who was admitted to Bellevue Hospital on October 18, 1913. She was the mother of twelve children, and about six years ago, after the birth of a child, she noticed that there was a protrusion in the median line which increased in size with each subsequent pregnancy. On admission, the patient, a large, fat woman, presented an abdominal tumor of huge dimensions. In the recumbent position this was easily reducible, and disclosed a separation of the recti from a point four inches above the navel to within an inch or two of the pubes. The gap between the muscles was large enough to insert two fists side by side.

The operation in this case proved comparatively easy, occupying less than an hour. A large, elliptical section of integument and fat, together with a corresponding section of the fascia, much thinned, was removed. No adhesions were found, but the recti could not be made to meet by several inches and their sheaths were not opened. The repair was made by the Blake overlapping method, in the same manner as in the first case. The fat having been carefully removed from the left flap, it was drawn underneath the right flap by mattress sutures. In order to preserve the blood supply of the superficial flap, its fat was not removed, while the peritoneum and the pro-peritoneal tissues were depended upon to take care of the nutrition of the deeper flap. The wound was dressed in a manner similar to that in the first case, it healed by primary union and the patient was discharged on November 12, 1913.

Blake's method of treating this form of hernia, Dr Vosburgh said, was described in *The Medical Record*, May 25, 1901. In his second case reported in that paper he did not dissect free the peritoneum, but included it in his flap. The Mayos' paper on umbilical hernia, published in the *Journal of the American Medical Association*, July 25, 1903, emphasized the importance of the dissection of the peritoneum and its independent suture, the deeper fascial flap being received in a pocket, as it were, of the superficial flap and its peritoneum.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

*Stated meeting, held at the New York Academy of Medicine,
November 26, 1913*

DR CHARLES H PECK, President *pro tem*, in the Chair

VENTRAL HERNIA

DR ARTHUR S VOSBURGH presented a woman, forty-four years old, who was admitted to Bellevue Hospital on September 17, 1913, suffering from a recurrent ventral hernia. Four years ago she had been operated at the Harlem Hospital for an umbilical hernia, and during her stay in that hospital a second operation was performed and an "eight-pound tumor" removed. Since then she had not menstruated.

Examination showed a large ventral hernia situated in the scar of the former operations. The mass, which was irregular and only partly reducible, presented several openings in the fascia. On September 19, 1913, under ether, the old scar was circumscribed and the peritoneum opened at a favorable point. The dissection of the intestines from their attachment to the old cicatrix was long and difficult. The intestines were held in a mass by broad adhesions. These were not disturbed, but all narrow bands were divided. The irregular openings in the fascia, one at the former location of the navel, the others nearer the pubis, made it impossible to do a Mayo overlapping operation, and the repair was accordingly made by coaptation obtained from side to side. Folded rubber tissue drains were inserted, a small dressing was applied along the line of suture, with broad bands of adhesive plaster incircling three-quarters of the trunk, covered by heavier dressing and an abdominal binder. The patient's

tion was imperative. The question naturally arose whether to do a primary bone transplant or a secondary one. The objection to the former was that there would be an open communication between the transplant and the wound in the mouth, but inasmuch as the only risk involved would be the loss of a few inches of one of the ribs, this method of procedure was decided upon, and on October 16, 1913, the involved section of the lower jaw was removed, extending from the second bicuspid back to the angle of the jaw, and including all the diseased bone, together with the soft tissues beyond the limits of the tumor. Silk sutures were inserted in the mucous membrane, three layers of catgut sutures beneath, and every precaution was taken to protect the wound from the mouth secretions. The tenth right rib was then exposed, and a section, together with its outer periosteum, was removed, and after trimming it to the proper size, it was inserted to fill the gap in the lower maxilla. A hole was bored in the jaw anteriorly with a Hudson drill and the anterior end of the rib pushed into it like a dowel. The posterior end of the rib was split vertically and made to fork over the lower end of the ramus of the jaw. This arrangement made a mechanically firm new jaw.

On the ninth day after the operation the wound showed some evidences of infection, due to communication with the mouth. But in spite of this the transplant remained firm. Six weeks had elapsed since the operation, and while there was still a small amount of discharge, the bone transplant gave evidence of being permanent, with preservation of excellent function of the jaw. Pathologically, the tumor was an adamantinoma. X-ray pictures, taken after six weeks, showed the piece of rib still in perfect condition, and in the position originally placed.

PITUITARY TUMOR FRAZIER OPERATION

DR JOHN F ERDMANN presented a girl of fourteen who was admitted to the hospital on June 10, 1913, complaining chiefly of a loss of vision, which was practically complete, the patient being scarcely able to discern between daylight and darkness. Her family history was unimportant. In childhood, the girl had whooping-cough, measles, scarlatina and pleurisy, and she had suffered from occasional attacks of tonsillitis. Her present trouble began in February, 1913, when she first noticed that she could not read properly, often missing or repeating words and

MULTIPLE OSTEOMYELITIS OF FIFTEEN YEARS' DURATION, CURED BY AUTOGENOUS VACCINES

DR A V MOSCHCOWITZ presented a man, thirty-two years old, who, seventeen years ago, suffered from an acute febrile disease, which, after three weeks' treatment at home, was diagnosed as osteomyelitis of the right femur. He was then admitted to the Mt Sinai Hospital, and after repeated and very extensive local operations, an exarticulation at the right hip-joint finally became imperative. During the following fourteen years, the disease successively involved the left lower jaw, the left malar bone, the right humerus, the left tibia, the left elbow-joint, the left ankle-joint and the lower part of the left femur, and in addition to these bone infections, there occurred also several subcutaneous, intermuscular and intramuscular abscesses. In every instance the infective agent was the staphylococcus aureus, which was also recovered from the blood. The patient was unable to state precisely the number of operations he underwent, but there were at least forty.

Finally, he was readmitted to Mt Sinai Hospital on March 28, 1911, with an extensive osteomyelitis of the upper two-thirds of the left femur. This was operated on, and from the pus the staphylococcus was again cultivated. From this, an autogenous vaccine was prepared, and during his stay in the hospital he received several billions of cocci subcutaneously. Two years and nine months had elapsed since that time, and in view of the fact that the longest period during which he had hitherto remained free from an acute exacerbation was only eight months, the speaker thought he might now be confidently presented as a cured case.

ADAMANTINOMA OF THE JAW

DR ALFRED S TAYLOR presented a man, thirty-seven years old, whom he had already shown at a meeting of the Society in 1909, after the second operation for an adamantinoma of the jaw, the first having been done in 1905.

In October, 1913, when the patient returned with a recurrence of the growth, about the size of an English walnut, it was evident that the lower jaw was so much eroded that further palliative procedures were out of the question and that a resec-

of fibrinous-like material and œdema. There was no histological evidence of tumor formation, the changes being of a degenerative and inflammatory character.

TUMOR OF THE HYPOPHYSIS

DR CHARLES A. ELSBERG presented a man, thirty-seven years old, who came under his observation in January, 1913, being referred by Dr. Emil Gruening. For two years the patient had complained of increasing deterioration of vision, without other symptoms. Dr. Gruening's examination showed that there was a temporal hemianopsia and a much contracted visual field on the left side, and that only slight light perception remained in the right eye. X-ray showed marked enlargement of the sella turcica.

The patient was operated upon by Dr. Elsberg at the Neurological Institute in February. The hypophysis was exposed by the transfrontal route of Frazier, and a tumor of the hypophysis—part of which surrounded the optic chiasm—was found. A large piece of the tumor was removed and proved to be an adenoma. Convalescence from the operation was uncomplicated and eyesight began to improve within 48 hours of the operation. The left field of vision steadily improved and most of the temporal defect has disappeared, while the sight of the right eye has not returned. The patient has been able to return to his work as a tailor, and is again able to sew and to read the newspaper. The scar from the operative incision is only slightly noticeable.

Dr. Elsberg presented a second case, in the person of a boy upon whom operation was done six months ago.

The patient had, for one year, increasing loss of sight in both eyes with frequent attacks of headache, he was referred to the speaker by Dr. Jelliffe. Examination showed that the left eye was blind, and that there was a temporal hemianopsia with markedly contracted field of vision of the right eye. X-ray examination showed a decided enlargement of the sella turcica, the posterior clinoid processes having entirely been destroyed.

Dr. Elsberg operated upon the patient, who was a very frail child, at the Neurological Institute, and exposed the sella turcica by the transfrontal route as modified by himself.

There was a marked collection of the fluid on the under surface of the left frontal lobe, and after this had been evacuated, further manipulations were deferred to a second stage. The bone

lines, and when reading she noticed that the left side of the book would become blurred. For three months previous to that time she had noticed that she could not see the blackboard from her seat in the rear of the school-room, and she was finally compelled to move to the front row of seats in order to see what the teacher was writing. The eyesight gradually grew worse, and in February she was compelled to leave school. Two months later she awoke one morning practically blind, and since then she has had continuous visions of different objects before her eyes. In April she began to complain of severe headaches, especially on the left side. These were only temporary. Her appetite was fairly good and she slept well. She suffered from constipation, also occasional vomiting, accompanied by nausea and vertigo. An examination of the eyes made by Dr. John E. Virden showed complete double optic atrophy.

Five weeks ago, Dr. Erdmann said, he operated on this patient by the Frazier method. Upon exposing the frontal lobe, he found a large collection of fluid between the dura and the arachnoid, which was removed by puncturing the dura. Upon exposing the sella turcica it was apparently slightly enlarged, and in the region of the floor of the sella a dark, grayish object protruded, resembling portions of a cyst wall. This was extirpated as completely as possible, and the wound closed.

For four or five days following the operation, the patient was very irritable, with a temperature ranging between 103° and 106° . This gradually subsided, and she left the hospital two weeks later. At the present time the optic atrophy was still apparently complete, although the patient insisted that she could at times distinguish certain objects.

Pathologically, the specimen showed disintegration of the structure of the pituitary body, with fairly well marked chronic inflammatory changes and localized areas of hemorrhage. There was a considerable development of hyaline connective tissue, which formed the wall of the "cyst," and passed through both the anterior or prehypophysis and the intermediate portions of the gland. The lymphoid cells and some polynuclears also suggested the presence of inflammation. The normal histology of the gland was greatly distorted, and the epithelial cells of the anterior lobe were compressed. In some sections there were areas

showed a T-shaped fracture with tremendous callus formation. By removing a portion of the latter from the region of the capitellum his flexion was increased 15° . There was but 30° of abduction at the shoulder with marked loss of power. Examination showed a fracture of the acromion process at its junction with the spine with very free motion between the fragments, the outer one having an excursion of one inch. On cutting down on the site of fracture, the fragments were found widely separated and joined by a band of firm connective tissue. The latter was cut away and the bone edges freshened. Holes were bored and two heavy twisted silk sutures passed, holding the fragments in good apposition. The shoulder was immobilized for four weeks. At the end of that time union seemed solid. Two months later there was no motion between the fragments and the motion at the shoulder had markedly increased. X-ray showed the fragments to be in close apposition.

DR BURTON J LEE said that about a month ago he saw a similar case where the accident had occurred as the result of a football injury, with about as much displacement as in the case shown by Dr Darrach. He made a vertical incision from the acromion to the tip of the coracoid process, and finding that the clavicle could not be replaced without removing the interarticular fibrocartilage, removed the latter structure. He then roughened the articular surfaces to secure at least fibrous union and passed two kangaroo ligatures through the coraco-acromion ligament and the clavicle and a third about the clavicle and through the coracoid process. The division of a few fibres of the trapezius at the outer part of the posterior margin of the clavicle seemed to be an essential feature of the operation. About four weeks had elapsed since the operation, and while the deformity was absolutely done away with, it was still too early to speak of the ultimate outcome as regarded function.

DR CHARLES H PECK said that several years ago he had a case where he inserted a Lane plate between the outer end of the clavicle and the acromion process, with the idea in mind of removing the plate later, if necessary. It held the parts in absolute apposition, and when it was removed, about two months later, restoration of function was very perfect, and there was no tendency toward a return of the deformity.

flap was returned into place and the wound closed. The improvement in eyesight was very marked and the temporal defect in the right eye has been steadily growing smaller, so that further operative interference has been put off indefinitely. The improvement is undoubtedly due to the decompressive effect of the operation. If necessary, a second operation will be done.

Dr. Elsberg also showed a patient from whom he had removed a mucous cyst from the frontal bone, with very satisfactory result, the deformity due to dislocation of the eyeball having entirely disappeared, and the scar being barely visible.

In connection with the first two patients presented by Dr. Elsberg, he made some remarks upon operations for exposure of the hypophysis, and stated that he believed that the transfrontal route suggested by Dr. Frazier, of Philadelphia, was an excellent method for exposing the contents of the sella turcica. The operation is not at all difficult, and the surgeon obtains an excellent view of the hypophysis—as good a view as one ordinarily obtains of the Gasserian ganglion in operations for removal of the ganglion or division of its sensory root.

The speaker described the modifications of Frazier's operation that he has adopted. These consist of removing part of the supra-orbital margin together with the bone flap and of making the base of the osteoplastic flap in or near the median line and thus avoiding an incision on the forehead. It is not necessary to remove part of the supra-orbital margin separately, but it can easily be included in the bone flap. The advantage of this is that there is no danger of necrosis of the supra-orbital margin when it is later replaced.

The speaker declared it as his belief that in properly selected cases the transfrontal operation was superior to any of the intranasal methods of approach, because the latter were, in the majority of instances, only decompressive operations.

FRACTURE OF THE ACROMION PROCESS OF THE SCAPULA

DR. WILLIAM DARRACH presented a man, fifty years old, who on May 12, 1913, was struck by a railroad train, receiving a fracture of the skull, of the lower extremity of the humerus and of the scapula. After three months' treatment in various hospitals he came to Roosevelt Hospital, August 20, 1913, complaining of limitation of movement at the shoulder and elbow. The humerus

SUBHEPATIC ABSCESS FOLLOWING OPERATION FOR
ACUTE APPENDICITIS

DR BURTON J LEE presented a boy, seventeen years old, who was admitted to Dr Roger's service in Bellevue Hospital on August 3, 1913, about 9 P M, and operated upon the following day by Dr Rogers. Upon opening the abdomen a markedly gangrenous appendix was encountered lying in an abscess cavity which contained about two ounces of pus.

Following the operation, the patient's temperature ranged between 99° and 103°, his pulse between 96 and 100. He complained of pain in the region of the wound and looked sick and miserable. His tongue remained heavily coated and his appetite was poor. His bowels responded satisfactorily to catharsis. On palpation, the abdomen was soft, without distention or tenderness, and examination of the wound itself on several occasions failed to reveal any definite pocketing of pus. His blood count, made two and a half weeks after the operation, showed a leucocytosis of 32,000, with 92 per cent of polynuclears, and this blood picture remained quite constant for a month after the operation. During this entire period the boy was steadily going down hill, with gradual loss of flesh, a weak, soft pulse, usually over 100, and an appearance indicating more and more sepsis.

A radiographic examination, made by Dr I S Hirsch three weeks after the operation, gave the following results. The chest showed the diaphragmatic shadow on the right to be considerably elevated, indicating a possible subphrenic condition. Physical examination of the chest was negative. A month after the original operation an area of definite tenderness was first made out just above the wound, directly below the right costal margin, at about the level of the ninth costal cartilage. No tenderness could be elicited by deep pressure in the right flank.

As the patient's condition was steadily growing worse, an exploratory operation was decided on, and this was done by Dr Lee on September 3, 1913. An incision was made roughly parallel to the costal margin on the right side, over the tender area, the rectus muscle being cut across and the peritoneum opened. The liver edge was recognized, and an exploring finger passed just beneath the liver, and above the hepatic flexure encountered adhesions. Upon breaking through these adhesions, an abscess

rotation, descent, and torsion has taken place can only be assumed. However, the general distribution of peritoneal adhesions in the foetus suggests the possibility of adhesions between the mural serosa and the peritoneum of the rotating colon having part in the causation of membranous pericolicitis of the left side as well as of the right

It is probable that an indeterminate proportion of pericolic membranes are of purely postnatal origin. Interesting in this connection is an observation of Bevan, who removed the

FIG 4.

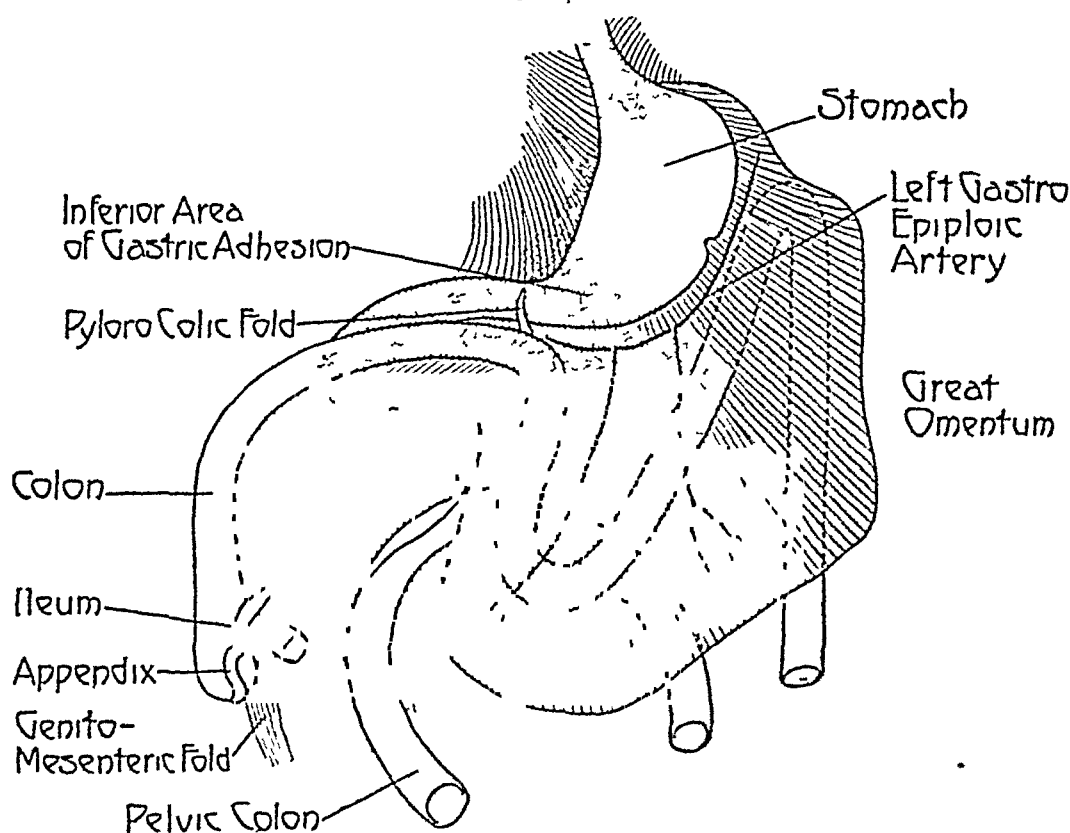


Diagram after Douglas Reid, showing area of peritoneal adhesion between the stomach and transverse colon in the foetus

vermiform appendix in a case showing no sign of pericolic membranes. A year later he re-operated, finding a well-developed membranous pericolicitis.

The discovery of pericolic membranes in the foetus does not explain their origin. The fact of their presence in the foetus and evidence indicating that such anomalous membranes are the result of peritoneal adhesion, for example between

in that position for five or six days At the present time they were carrying on some work in the X-ray laboratory with the object of demonstrating the value of that position after certain abdominal operations

DR PECK said he was quite firmly convinced that iodine peritonitis did occur from time to time, and he recalled two instances where he thought that absolute proof of that fact had been found In one of those cases there was an immense mass of adhesions which he attributed to contamination with iodine About the same time he operated on another case, an inoperable carcinoma of the rectum, where death occurred within two weeks and where the autopsy showed plastic adhesions in all parts of the peritoneal cavity, which had been contaminated with iodine at the time of the operation by exploration with the gloved hand, while regions not so invaded were entirely free from adhesions

Dr Peck said that since that time he had seen several cases with extensive intra-abdominal adhesions which he thought could be ascribed to the use of iodine

DR PARKER SYMS thought the suggestion made by Dr Lyle was a very valuable one, but as to the cause of post-operative adhesions, he was inclined to attribute them to peritonitis, most probably due to a more or less mild type of infection Of course peritonitis may be due to a chemical irritant

The only case of this kind that has come under his observation in the last few years happened to be one of the few cases in which he has not used iodine in the preparation of the skin

DR LYLE, in reply to a question, said that while he had abandoned the use of iodine in these cases, the post-operative adhesions in the case he had presented were apparently not the result of the iodine, as had been demonstrated by keeping this patient in the left lateral position after the third operation In using iodine, if the bowel came in contact with the skin, it had been shown that the former gave the iodine reaction

DR MOSHCOWITZ said that at the Mt Sinai Hospital he used iodine only in those cases where there were special indications for it, such as a sinus infection In other cases they depended on soap, ether and bichloride Personally, he had seen iodine produce an annoying dermatitis, particularly where it came in contact with the adhesive plaster

cavity was opened containing a few ounces of thick, yellowish pus, with foul odor. This cavity did not, apparently, connect directly with the original abscess cavity in the appendicular region. Drainage was secured with a cigarette drain and rubber tube. The boy's recovery was without further incident, and he was discharged from the hospital on October 20, 1913, with both sinuses healed and in good physical condition. At the present time his health was excellent and the wounds seemed firm.

INTESTINAL ADHESIONS FOLLOWING APPENDICITIS

DR HENRY H. M. LYLE presented a girl who was originally operated upon at St. Luke's Hospital on September 26, 1911, when a chronically inflamed appendix was removed. She made an uneventful recovery and returned home. Subsequently, symptoms of partial intestinal obstruction developed, these gradually became more pronounced and she returned to the hospital eight months later, suffering from what was supposed to be post-operative adhesions, which were attributed to the use of iodine on the skin at the time of the operation, for at that time no precautions were taken to protect the iodized skin. In the second operation no iodine was used. There were no adhesions to the abdominal wall, but the omentum had bound the ascending colon and cæcum to the transverse colon. This was freed, the raw surfaces were covered and the area touched with albolene. No abdominal pads were used.

Within a month a similar train of symptoms developed and the patient returned for a third operation. This time they were certain that the iodine was not to blame, and from the nature of the symptoms they concluded that they had to deal with the same condition. The third operation was performed in September, 1912. Precisely similar conditions were encountered and they were treated in the same way, excepting that the patient was placed on her left side, with her right side up, and was kept in that position. This time she made a perfect recovery and had since remained well.

Dr. Lyle said he had had occasion to reopen some of his own abdominal cases, as well as those of other surgeons, and in studying them he had been struck by the frequency with which the above conditions were found, and this had led him to place all clean cases on the left side, with the right side up, and keep them

THORACIC ANEURISM TREATED WITH MERCURY AND
SALVARSAN,

DR WILLIAM C LUSK showed five cases of thoracic aneurism which had been treated with mercury and salvarsan, the details of which are reported in his paper read at this meeting. Cases I, II and III, early in their treatment, had been given a significant amount of potassium iodide besides, which was stopped, however, when the existence of an incompatibility between it and salvarsan was believed to have been observed. The first four of these cases were the same ones that he had shown before this Society just one year ago, as results of the operation of wiring with electrolysis. These four cases were all of them to-day much stronger and healthier, capable of much greater activity, and freer from the sense of impending return of symptoms, than they were a year ago, and were now possessed with a sense of well being not then entertained.

Case I had in the year's interval nearly strangled a number of times, and now he was able to walk easily a mile and a half a day. Cough and expectoration were very little and he slept all night. He had not been able to work.

Case II a year ago, taking mixed treatment, was working as bar-tender in comfort as long as he was taking his mixed treatment, but whenever he stopped his medication pain would recur, usually following exertion. To-day he has much greater physical endurance, being in excellent health, standing all day in the bar, walking about two miles a day, and the only thing that has recently excited a little pain has been when he has walked a little fast as far as seven or eight blocks, the pain subsiding as soon as he rests.

Case III, who has always been capable of greater physical exertion than any of the others, after having had mixed treatment followed by neosalvarsan, during last spring and summer undertook considerable labor of quite a heavy nature. His excessive exertions would always end sooner or later in producing temporary pain. In June he spat up blood in mouthfuls. In October and early November, during which time he was not strenuously employed, he had a little pain for an hour or two a day, probably the result of his physical excesses during the summer. On November 15 he walked ten miles without any pain resulting. His

DR ERDMANN said that after a very extensive use of iodine preliminary to abdominal operations during the past three years, numbering at least 300 patients, he had only seen a dermatitis produced in two, and in those cases where it was used in connection with adhesive plaster, there was less irritation underneath the plaster than outside of it. He could not recall a single instance where post-operative intestinal adhesions could be attributed to the use of the iodine. In the application of the iodine, the speaker said, they had dispensed with the preliminary swabbing with benzine.

DR WILLIAM A. DOWNES said he had used the iodine for the past three years, since Dr Gibson read his paper on the subject before the Surgical Society, and his results had been practically in accord with those of Dr Erdmann. In the use of the iodine, no friction should be employed, either at the time of its application, or when the operation is completed, such as is produced by the use of alcohol on gauze in the effort to remove the excess of iodine remaining on the skin. The skin surface should be dried gently before dressings or adhesive plaster are applied and blistering will practically never occur.

DR ELSBERG said he had used iodine for a number of years in practically all kinds of operations, and his results had been very satisfactory. In the beginning, he had been conservative in using the method, but with increasing experience, he had come to the conclusion that iodine sterilization was both safe and efficient. In abdominal operations, however, procedures should be adopted which would prevent the iodine being carried to the peritoneal coverings of the abdominal viscera which would result in the formation of adhesions. This can be satisfactorily accomplished by fixing towels to the edges of the peritoneal surfaces by means of small clamps.

DR PECK said that if the skin was properly protected and the peritoneum was guarded against contamination, there was comparatively little danger of resulting post-operative adhesions. On the other hand, such adhesions might result from the use of the iodine without the knowledge of the surgeon unless they were subsequently brought to his attention accidentally, as they undoubtedly are absorbed within a few weeks, and generally produce no symptoms.

BOOK REVIEW

A MANUAL OF SURGICAL TREATMENT By SIR W WATSON CHEYNE, Bart, C B, D Sc, LL D, F R C S, F R S, Hon Surgeon in Ordinary to H M the King, Senior Surgeon to King's College Hospital, and F F BURGHARD, M S (Lond), F R C S, Surgeon to King's College Hospital, and Senior Surgeon to The Children's Hospital, Paddington Green, London New (2d) edition Thoroughly revised and largely rewritten In five octavo volumes Lea & Febiger, Publishers, Philadelphia and New York, 1913

Volumes I to IV have already been reviewed in the ANNALS OF SURGERY, Volume V is now before us It treats of (1) surgical affections of the pancreas, liver, and spleen (6 chapters); (2) surgical affections of the neck (7 chapters), (3) surgical affections of the breast and thorax (10 chapters) The rest of the book, nearly 400 pages, is devoted to affections of the genito-urinary organs

The high standard attained in the previous volumes is fully maintained in this valuable and interesting work Too much praise cannot be expressed for the thoroughness and soundness of the work and the clearness with which the practical side is emphasized The work is unique in its scope and can be consulted to advantage by even the most experienced, and the beginner will find it a regular treasure-house of useful information

The only section that does not compare quite favorably to the rest of the book is that devoted to affections of the genito-urinary organs Here, the procedures and armamentarium recommended are in many cases much behind the time We note with some regret that, like many other distinguished operators, the senior

Wassermann, which last February had become negative, has recently become mildly positive again

Case IV was one who after his wiring (October 1, 1912) neglected to take mixed treatment and pain began to recur in about ten weeks. The few doses of mixed treatment which he was induced to take helped his symptoms, but he got worse until neosalvarsan was administered (April and June, 1913), after which his symptoms were relieved and his power of endurance greatly increased. He had no trouble all summer, doing light work in a club, and walking three or four miles a day. Early in September he began to have occasional pains, which with injections of mercury salicylate and two small doses of salvarsan, have now practically disappeared again.

Case V came under observation the end of August with a huge aneurism $6\frac{1}{2}$ inches broad and 4 inches high, projecting from the upper part of the thorax and base of the neck, which had first put in its appearance five months before. With intramuscular injections of mercury salicylate and small doses of salvarsan, the tumor had increased in size only one-quarter inch in its vertical diameter, the tension and expansibility were both much diminished, and the pain, which before was continuous, was now very slight and dependent upon posture.

THE ANTISPECIFIC REMEDIES IN THE TREATMENT OF THORACIC ANEURISM

DR WILLIAM C LUSK read a paper with the above title

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the rotating colon and the mural serosa, still leave in doubt the nature of the process which actually causes the two serous surfaces to adhere, and, until otherwise proven, it seems fair to suspect, in the case of the foetus as well as of the adult, such well-known causes of adhesion as infection, mild or severe, and mechanical or other irritation

The rather frequent occurrence of membraniform adhesions in dogs² emphasizes the likelihood of continued colonic stasis having an important part in their causation, as contended by Gerster, and supplies evidence to the effect that the upright posture is not an essential factor of their etiology

It is of some interest to note that the extensive attachment of the left margin of the great omentum to the lateral mural serosa, as observed in our case, represents simply an extreme exaggeration of the adhesion which forms the apparently normal ligament of Toldt

² Eisendrath, Journal A M A, August 30, 1913

author has yielded to the temptation of describing a new method of performing nephiopexy

The thorough revision of the first edition of the book with admirable condensation and the great pains taken to bring it up to date, whilst avoiding the pitfalls of new and untried measures, gives this splendid work a place in our surgical literature which will last for a long time

CHARLES L GIBSON

TO CONTRIBUTORS AND SUBSCRIBERS

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the living, contacting extremities into the graft The periosteum takes no part in the actual reproduction of new bone

To analyze Dr Murphy's transplantations a little further I may say that I have gone through all of his reported transplantations with the object of finding out just what was done with the periosteum in each procedure In a number of cases this was not stated In all such instances I have ascertained from him in writing exactly what was done with the periosteum In not a single instance did he omit to transplant grafts with more or less of their covering periosteum From a practical stand-point I judge that he does not know just what would have happened had he transplanted grafts without their periosteum, so that his conclusions as to the function of the periosteum are conjectural only

We know that practically every graft made with its periosteum will permanently live, if asepsis be attained What will happen to grafts made without their periosteum? Following the publication of Macewen's monograph, "The Growth of Bone," in which no osteogenetic power is attributed to the periosteum, I made four human transplantations without periosteum and in every case the graft was ultimately absorbed That led me to perform a large number of animal experiments, which are published in full in *Surgery, Gynecology and Obstetrics*, Feb, 1914, and in the *Journal of the American Medical Association*, Jan 31, 1914 Every graft made with periosteum lived Of 25 grafts made without periosteum but 48 per cent lived That led me to conclude that the blood supply of the graft was the all important factor Since we have no way of knowing in which cases the blood supply will be sufficient, if grafts be without their periosteum, the conclusion seems irresistible that grafts should always be made with periosteum upon them This will assure subsequent life to practically every graft so made, if asepsis be attained The conclusions that I formulated, with a proof of each, are as follows (they form a fairly complete set of rules for making transplantations)

- 1 If a section of the whole diameter of a bone be removed,

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No 4

ORIGINAL MEMOIRS.

THE METHODS SUGGESTED FOR BONE TRANSPLANTATIONS.

BY CLARENCE A. McWILLIAMS, M.D.,

OF NEW YORK,

Assistant Surgeon, Presbyterian Hospital

BONE transplantation has become a well recognized and successful surgical procedure. Perhaps no other one thing in surgery has created a greater discussion than the function of the periosteum in bone transplants and what it accomplishes. To understand the subject it will be necessary to give the three views of leading authorities as to the life of grafts.

1 The universally accepted view in Germany is that of Axhausen, who maintains that the bone in a graft always dies, is absorbed and is reformed from the periosteum, which alone remains living in transplants.

2 The second view is that of Macewen, of Glasgow, who says that the bone in a graft is reproduced from the proliferation of osteoblasts, derived from the osteoblasts within the bone of the graft itself, and its regeneration takes place independently of the periosteum, whose only function is that of a limiting membrane, which prevents the spread of the osteoblasts into the surrounding tissues.

3 The third view is that of Murphy, who says that the graft is not osteogenetic but simply osteoconductive. Provided it be in contact at one or both extremities with other living bone, the graft acts simply as a scaffolding for the growth of the capillaries with their osteogenetic cells as they advance from

3 Provided that a graft be living and taken from the same patient, who is to be grafted, its future life depends on an efficient blood supply, irrespective of either the periosteum, or whether the graft is in contact with living bone or not This conclusion I desire to most emphatically emphasize The blood supply seems to be favorably influenced by the periosteum, since 100 per cent are successful with it and but 48 per cent without it Hence the teaching is clear to always transplant grafts with periosteum

4 If minute fragments of a living graft be transplanted, then the periosteum may more readily be disregarded because the osteoblasts in the fragments may not die because of an easier access of blood to them, and the pieces of bone may grow and coalesce and not become absorbed My statistics show that 50 per cent of such procedures will be successful Proof

Fig 3 Experiment 9 This animal was killed five months after one inch of the radius was removed, together with its periosteum The periosteum was then scraped off the fragment, which was split into as small pieces as possible with the rongeur The small fragments were replaced, filling in the defect in the radius Result The small fragments have all remained alive, have coalesced into one piece, which has become united to the ends of the radius fragments

This experiment illustrates the influence of a good blood supply upon grafts See also Macewen's case under "Methods of Bone Transplantation," No 1

5 If a large piece of living bone be transplanted, then it is much safer to leave the periosteum attached to the graft, in order to be sure of its future re-formation, since otherwise the osteoblasts in the bone of the graft will probably die because cut off from a sufficient blood supply The periosteum survives because of its adequate blood supply from the surrounding tissues, its inner surface forms osteoblasts, which themselves proceed to re-form the bone of the graft, in the event that the osteoblasts within the transplant itself have died from a deficient blood supply My statistics show that 41 per cent of procedures are successful in which large grafts without periosteum are transplanted Proof

then the bone will regenerate between the ends of the fragments, if the whole, or a part of the periosteum, bridging the defect, be preserved Proof

Fig 1 Experiment 3 This animal was killed eight months after subperiosteally resecting a section of a rib This rib without periosteum was then split into longitudinal strips and these were transplanted into the abdomen Result The defect in the rib, from which the periosteum was not removed, has become entirely filled in with new bone The strips, transplanted into the abdomen have remained intact, have grown together, and have increased in size A photomicrograph of a section of this abdominal transplanted bone, shows bone perfectly alive, not undergoing absorption, and containing well preserved and normal marrow I attribute the living of these transplants to the fact that the splitting of the original rib allowed sufficient blood to get to the bone cells

This is a refutation of Dr Murphy's conclusion, in which he says that bone, with or without its periosteum, when transplanted into the soft parts and not in contact with living bone, always becomes absorbed This was one of the cases in which the graft transplanted without periosteum did not become absorbed I have a number of such experiments

2 If a section of the whole diameter of a bone be removed, there will take place very little subsequent filling in of this defect by new bone, if the entire periosteum has been removed from between the ends of the fragments To have such a defect fill in, it is necessary that there shall be left either some portion of periosteum or a thin layer of bone, bridging the defect Proof

Fig 2 Experiment 2 This picture was taken six months after resecting the whole diameter of a rib, together with its periosteum The defect has not at all closed in, due to the lack of periosteum The periosteum was stripped bluntly from the bone section and this strip of periosteum was transplanted into the abdomen (A) Result after seven months A transverse section was cut through this periosteum (A), which was felt to be bone A microphotograph of this section gives a picture of normal, healthy, living bone, surrounded by a closely investing, connective tissue capsule There are no osteoclasts present nor any round cells, suggestive of either a destructive or an inflammatory process

This result shows that transplanted periosteum may produce living bone, contrary to Macewen and Murphy's opinions

FIG 2



Experiment 2 Strip of periosteum without bone 1 transplanted into the abdominal wall
has produced new bone

FIG 3

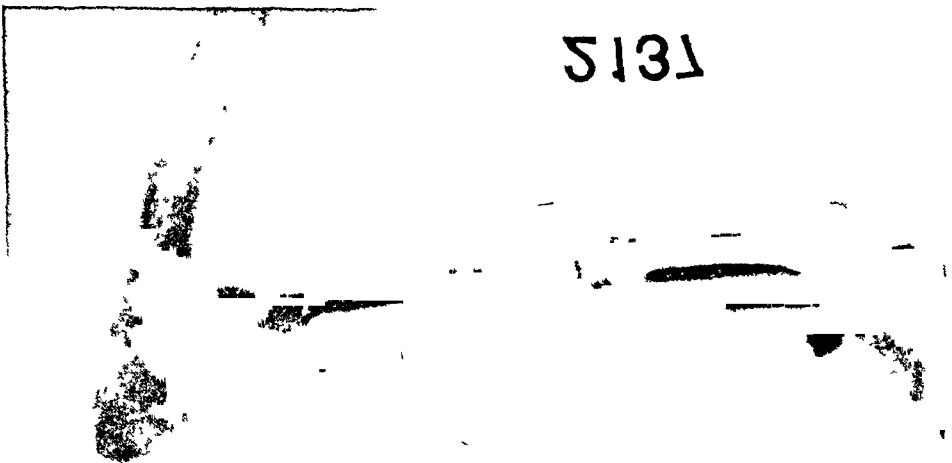


FIG - 3

Experiment 9 Small fragments without periosteum transplanted into a defect in the
radius have lived and have all grown together

FIG 1



pure
'scent 3

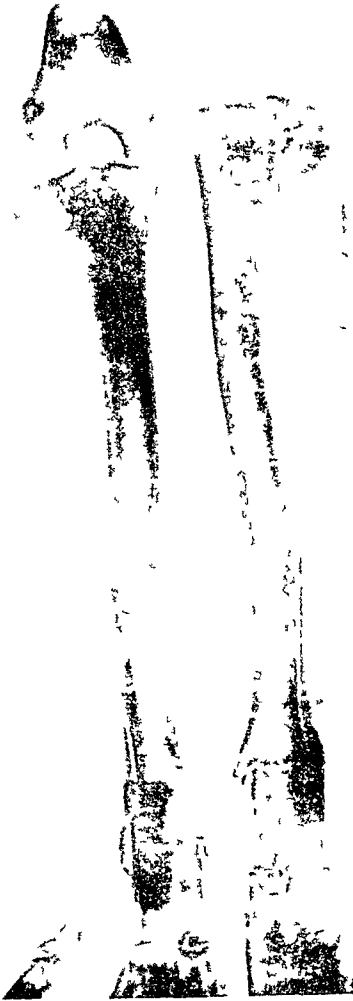
Experiment 3 Strips of a rib without periosteum transplanted into the abdominal wall
not in contact with living bone have remained living and have grown together

FIG 5



Experiment 26 Piece of periosteum from right fibula section, transplanted into muscles of left leg has produced new bone Right fibula segment into left defect without periosteum has disappeared Left fibula segment transplanted into muscles of right leg with periosteum with no bony contact has remained living

FIG 4



Experiment 23 Right fibula without periosteum transplanted into left fibula defect in contact with old stumps has entirely disappeared Into muscle of right leg was transplanted the left fibula with periosteum This has remained living, although it was not in contact with living bone

7 Contact with living bone is not necessary for the subsequent life and permanency of living grafts, as has been maintained by Murphy Experiment 26, under conclusion 6, Fig 5

8 From a consideration of all the foregoing facts, the conclusion seems irresistible that bone grafts of whatever size should be transplanted with as much periosteum covering their surfaces as is possible, if one is to be positively assured of their subsequent survival. It seems probable that the influence of the periosteum is exerted in maintaining the nutrition of the graft. We must conclude that both Macewen and Murphy are mistaken in their conceptions of the lack of function of the periosteum in maintaining the life of grafts. Murphy must likewise revise his conclusion that the graft is not osteogenetic in itself, that it is simply osteoconductive of cells into the graft from the contacting living bone. I have proved that contact with living bone is not necessary for the permanent life of grafts.

9 Finally, periosteum transplanted into the soft parts may produce new bone.

Indications for Bone Grafting (modified from Murphy, *J A M A*, vol lviii, 1912) —1 To correct deformities resulting from defects of development, as aplastic extremital bones—radius, ulna, humerus, tibia, fibula and femur, and congenital and acquired saddle-nose, aplastic mandible, spina bifida, etc

2 To produce union in ununited fractures. This is the best treatment and much superior to Lane's plate.

3 To replace bone removed by destructive infections, osteomyelitis, tuberculosis, lues, etc, *e g*, spina ventosa.

4 To restore or supplant fragments dislodged or destroyed by fractures, as the head of the humerus, head of femur, shaft of tibia, etc.

5 To replace bone removed for non-malignant neoplasms, cysts, myeloma, osteitis fibrosa, adamantinoma of jaw.

6 To replace bone removed for encapsulated malignant disease, as giant cell and chondrosarcoma, etc.

7 To immobilize joints, as, for example, those with too

Fig 4 Experiment 23 Dog 423 Operation A section from the right fibula intact without periosteum was transplanted into left fibula defect in contact with old stumps The stumps of the right fibula defect were covered with muscle, which was sutured over them Under fascia of right leg was placed the entire section from the left fibula with periosteum still on it uninjured, there being no contact of this graft with living bone. Result 81 days after the operation The section into the left fibula defect without periosteum has almost completely disappeared There is a slight line left indicating a persistence of some of it This disappearance has occurred notwithstanding that it was in contact at both ends with living bone The difference the presence or absence of the periosteum makes is indicated in the right leg. The section from the left fibula into the right fibula defect with periosteum has remained of its original size and seems perfectly alive, this notwithstanding that it was not in contact with living bone.

This experiment is another evidence that Murphy is not correct in his statement that grafts must be in contact with living bone in order to live This experiment would also seem to indicate that the periosteum is the important element in maintaining the life of grafts, probably due to its influencing favorably the blood supply.

6 Periosteum alone when transplanted into the soft parts may produce living bone Proofs Experiment under conclusion 2, also the following

Fig 5. Experiment 26 Dog 426 Sections from each fibula were excised From the section from the right side, all the periosteum was bluntly stripped off from all its sides in one piece This piece of periosteum was vertically stretched out under skin of left leg The bone itself from the right fibula without periosteum was placed in contact with the ends of the old stumps in the left fibula defect Over the ends of the stumps of the right defect in fibula, muscle was sutured so that the graft would not be in contact with living bone and in the superficial muscles of the right leg was placed the section from the left fibula with its periosteum entire Result 102 days after operation The section of bone with periosteum in right leg, not in contact with living bone, has grown to two or three times its normal size and is certainly perfectly alive The piece of fibula without periosteum into left defect from right fibula has entirely disappeared This is probably due to the fact that the bone was transplanted entire. Had it been split, as in the preceding two experiments, it more than likely would have survived, due to the consequent better blood supply. The periosteum on the other hand, transplanted under the skin of left leg, has developed a new mass of bone of the size and shape of the old fibula from which it was taken

great laxness or imperfect muscular control, resulting from infantile paralysis or Charcot joint, and for the cure of tuberculosis of joints, as in bone grafting for tuberculous spine (Albee's operation)

General Principles to be Observed in Bone Transplantations.—No cavity which is septic should be filled with transplanted bone as the graft will die and slough out. All wounds should be perfectly healed before transplantation is attempted.

Most scrupulous asepsis is an absolute essential. No graft should be handled by the operator. It should be grasped by instruments and thus inserted in its new bed.

The living graft should be transplanted always with periosteum on it. This is most important.

The graft should be taken living from the same individual who is to receive the transplant. If this be not possible, then it should be taken from as near a relative as possible. Animal bone should not be used, if it is possible to avoid it, because it will be absorbed owing to the changed serological relations. If taken from another individual, the grafting should not be done until syphilis is ruled out by a Wassermann reaction.

When the head of the humerus or femur is fractured and dislocated and the joint is opened, then the head should be replaced and attached to the freshened lower fractured surface, even though the head be dead, provided it is still aseptic.

All foreign non-absorbable material, wires, nails, celluloid, rubber, etc., should be avoided as implants unless under very exceptional conditions. Encircling wires will erode the bone and a fracture may result. These non-absorbable foreign bodies tend to irritate, if not invite suppuration, and often produce sinuses which will usually require their removal to cure the sinuses. Chromic gut should be used to fix the grafts in position, avoiding nails and wires for the above reason, and living bone grafts should be taken from the same patient who is to receive the graft, if possible.

A graft increases in size according to the demands put upon it by the organism. Experience has taught that it is not necessary to fill up completely with a living graft a defect. A much

CANCER AND PRECANCEROUS CONDITIONS.

BY WILLIAM L RODMAN, M.D, LL.D.,

OF PHILADELPHIA

Professor of Surgery in the Medico-Chirurgical College, Surgeon to Presbyterian and Blockley Hospitals

AT no time in the world's history has that ancient, pitiless and ubiquitous, hence most dreaded enemy of mankind, cancer, been studied so generally, so systematically, so unceasingly as during the recent past. State and philanthropist the wide world over have entered upon its pursuit with unlimited energy, talent and means, and if the quest has not been entirely fruitful, no unbiased critic can say that it has been fruitless. Much has been revealed concerning the history, pathology, and treatment of carcinoma, even though its direct or exciting cause remains the great unsolved problem of the day, as it has been of the ages.

Unfortunately too, and it should be candidly admitted, but little additional information has been given to the clinician which might enable him to detect unerringly, in its early stages, a foe so stealthy that mastery over its victim is oftentimes complete before its recognition, since a disease strictly local, and therefore curable primarily, has become, through metastases, a general, constitutional and incurable one. Not only is this true of deep-seated and internal carcinomata, as one might reasonably expect, but almost is true of superficial or external lesions, susceptible of either palpation, sight, or both.

Important, superlatively needful, as it is to ascertain, if possible, the cause of cancer, are we not, in its search, neglecting valuable means already at hand, facts proven to the hilt, which if employed rightfully and in time would undoubtedly save thousands where hundreds are now being saved?

Will it not startle some of you, experienced surgeons that

* Annual Oration of the Academy of Surgery of Philadelphia delivered October 6, 1913

size than the first were similarly dealt with and inserted two months subsequently to the first graft, and a third couple were placed in position five months after the first. These all fused together and to the condyles of the humerus, filled the gap in the arm to the extent of four and a quarter inches. It is now 30 years since the humeral shaft was rebuilt, and during all that period the man has depended upon his physical exertions for the earning of his living. He worked as a joiner for many years, and is now an engineer's pattern-maker.

Macewen also relates the following experiment. This experiment I have myself duplicated with precisely the same result in several dogs but not always.

The greater part of the shaft of the radius with its periosteum was removed. The shaft of the bone removed, destitute of its periosteum, was then cut into very fine shavings and these shavings were placed between the muscles, which bulged into the gap left in the bone by the removal of the shaft. The neighboring muscles were then attached over the bone shavings in order to keep the shavings in position, and especially to prevent their being extruded from the wound. Examination of the specimen obtained seven weeks after operation showed that the continuity of the shaft was entirely restored. There was a marked increase in the diameter of the shaft opposite the part where the shavings had been inserted. All the component parts had become fused by osseous tissue into one another and both ends of the shaft.

The method of transplanting small chips does not seem to have as great an advantage as transplanting a large single fragment with periosteum for the reason that small chips are less liable to have periosteum on them than large ones, and consequently some of them will die and become absorbed. This I have noticed also by experiment. The teaching seems clear that in simple, comminuted fractures, one should not remove loose fragments, particularly if there be any periosteum on them. They should be replaced, if kept aseptic.

Technic—Let us suppose the grafting is for ununited fracture, expose the ends of the fragment, remove all fibrous tissue between them and freshen the ends by sawing them off. The favorite bones from which to get the grafts are the tibia, clavicle, rib and upper third of ulna. Tibia is probably the best. Remove from it, as described under the next section, a length of bone sufficient to bridge the defect, with periosteum on one of its sides. With chisel divide this piece of bone into

smaller living transplant with its periosteum may be used which will increase to the size necessary This statement is fixed and settled by many transplantations

After transplantation absolute immobilization is essential for success This should be maintained for at least five months, longer if roentgenograms show its necessity.

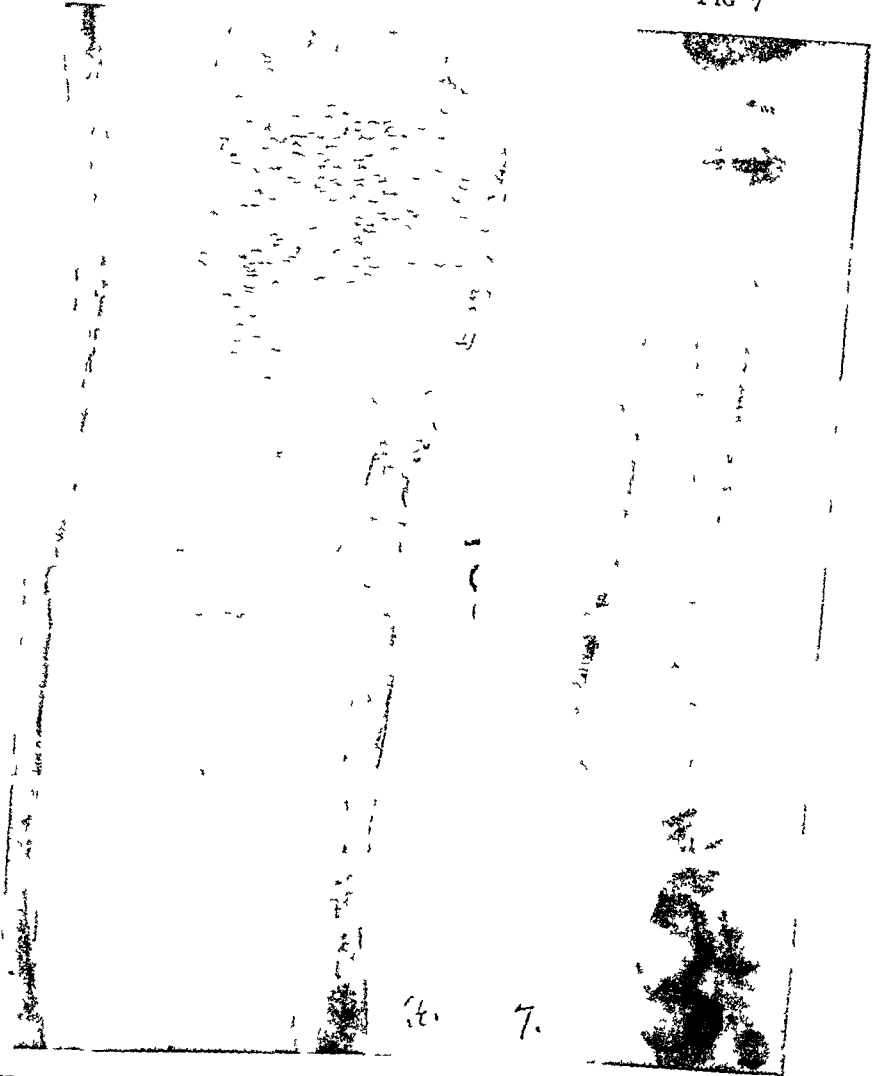
An Esmarch tourniquet had best not be employed, since it predisposes to subsequent oozing, and blood would be effused about the graft, whose nutrition is thus injured and the tendency to suppuration is increased

Methods of Bone Transplantation (modified from Binnie)
—1, Transplantation of small bone chips with as much periosteum as possible, 2, transplantation of free, non-pedunculated, large fragments, always with periosteum covering at least one side, 3, transplantation with pedunculated bone flaps, the pedicle being either permanent or temporary and the bone taken either from the same bone which is to be grafted or from a neighboring bone, 4, transplantation combined with arthroplasty, implantation of a part of the length and the whole thickness of the shaft of a bone with one articular end, 5, transplantation of periosteal flaps (Codivilla's operation), 6, transplantation for congenital absence of tibia, 7, transplantation of dead bone, either decalcified bone chips or large fragments; 8, transplantation of absorbable or non-absorbable foreign material, 9, transplantation of joints

1 *Transplantation of small bone chips* The following is an illustrative case

MACEWEN in his book mentions the case of a boy, the whole of whose diaphysis he was compelled to remove for necrosis There was no subsequent osseous deposition Fifteen months later he was readmitted with the request by the parents that the boy's useless arm be removed Two wedges of bone were excised from another patient of six years of age afflicted with anterior curves These were cut into minute fragments, quite irrespective of the periosteum, and were then deposited into the muscular sulcus in the boy's arm There was no pus formation Two months later a portion of new bone, an inch in length and three-quarters of an inch in thickness, was found firmly attached to the upper fragment of the humerus Here all the grafts proliferated, grew to one another, and also to the extremity of the proximal portion Two other wedges of bone of larger

FIG 7



Human transplantation Graft without periosteum into tibial defect

Same patient after six months Graft is disappearing

small fragments with periosteum on each fragment if possible. Fill the defect to be closed by these fragments. Close the wound without drainage and immobilize.

2 *Transplantation of non-pedunculated large fragments, but always with their periosteum.* Success is assured if the periosteum be on the grafts, if asepsis be attained.

The following case is illustrative of free large bone grafts and how important it is to have periosteum on grafts. Two transplantations were performed, the first time, following Macewen's teaching, without periosteum. The graft was absorbed. The second time periosteum was on the graft and the result was perfect.

CASE I—This is an exceedingly interesting case of non-union in a birth fracture of both bones of the leg in a child 17 months old. The non-union I attribute to insufficient immobilization of the leg. I cut down upon the fracture and after freshening the pointed extremities of the fragments, there resulted a defect of an inch and a half in the tibia, which made transplantation of bone necessary. A graft (Fig 6) from the opposite tibia was chiselled out with its periosteum. The periosteum was then deliberately peeled off the graft with the object of confirming Macewen's view of its unimportance. One end of the graft was pointed and it was wedged into the medullary cavity of the upper fragment, and the lower side of the transplant was spliced to the side of the lower fragment with chromic gut. The subsequent union of the wound was by first intention. The next picture shown (Fig 7) was taken six months after the grafting. It was very disappointing to see the tibial graft gradually melt away in the tissues, so that, after six months, it was not more than one-quarter its original size. Since union was by first intention, there seems no way of accounting for the death of the graft save on the basis of a lack of periosteum, or of a deficient blood supply, or both.

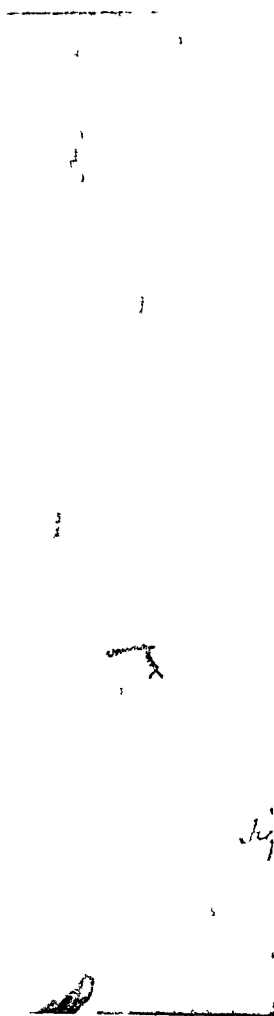
Six months after the previous grafting operation, I transplanted five inches of the opposite healthy fibula into the medullary cavities of the fragments, as is seen in the picture, Fig 8. It was transplanted with the periosteum covering its entire circumference and this was not split in the slightest. The result shows that this splitting of the periosteum on a graft is entirely unnecessary.

and accomplishes nothing. Below a wire encircling suture was used to hold the graft in place

Fig. 9 was taken six months after the transplantation. To my mind it seems to imply the necessity of revising Dr. Murphy's conclusion that a graft is not osteogenetic in itself. A fracture has taken place in the lower third of the transplant, due to the fact that the child kicked off the splint one night. We see that the upper portion of this fracture of the graft itself is consolidating nicely under an enormous callus. If we accept Dr. Murphy's conclusion, we must believe that all this callus came through the graft from the contacting old bone of the neighboring stumps. I do not accept this view for a moment, but believe that the callus arose either from the periosteum or from the bone of the graft itself. Along the outer surface of the graft we see at least a quarter of an inch of new bone evenly distributed. Were this new bone formed from the contacting ends of the old bone of the stumps, it seems to me that it would shade off, becoming less the further we went from the old bone. As a matter of fact, the greatest amount of new bone is at the fracture spot in the graft, which is at some distance from either contacting extremity of old bone. The lower fragment below the fracture, due to the inhibitory influence of the wire, has scarcely developed at all and it is being eroded by the wire. On June 9, 1913, I removed this wire, when the lower fragment started immediately to develop. Fig. 10 was taken four months after the wire was removed. The fracture is healed and the callus has disappeared. Consolidation is progressing nicely between the lower end of the lower fragment and the upper end of the lower shaft.

Technic—Let us take, for example, an ununited fracture. Bone grafting is the operation of choice in such a condition. Expose the ends of the fragments, remove all fibrous tissue from between them and freshen the ends by sawing off sections. The bone graft may be chosen from the tibia, rib, upper third of ulna, clavicle or crest of ilium. If the rib be chosen, periosteum should be taken covering half its surface, so as to avoid opening the pleura. The tibia is the easiest and the most frequently employed bone from which to get the graft. A curved incision through the skin is made beginning at its

FIG 8



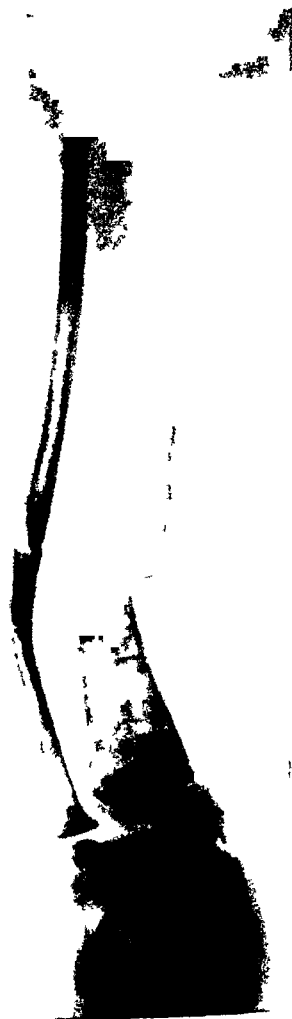
Same patient after second transplantation. Into the medullary cavities of the tibial extremities was inserted a section from the same patient's opposite fibula with periosteum on all sides.

FIG 9



Same patient six months after the second transplantation. The graft has increased enormously in size, but it has been fractured with the production of an enormous callus. The fracture is healing nicely. The wire is eroding the graft.

FIG 10



Same patient four months after the removal of wire. Fracture has healed and the lower part of the graft is developing.

are inserted through them and tied. Murphy prevents the graft from riding up the medullary cavity by inserting a nail through the fragments and graft, but it seems wise not to use any foreign body which may later irritate. It is not necessary for apposition to be maintained between the ends of the fragments of the fractured bone though this is desirable. In this way can be overcome the shortening of the extremity. The graft has periosteum on two of its surfaces and medullary tissue on the other and will positively live if asepsis be attained. Both wounds are closed without drainage and the fractured limb is immobilized.

BITTNER resected the lower half of the shaft of the tibia for sarcoma, leaving the lower epiphysis. He filled the gap by splitting longitudinally the remaining half of the shaft up into the tuberosity, turning the segment down and fixing it in place. Only 15 cm shortening resulted and the leg was strong and useful.

SIEVERS (*Beitrag zur kl Chir*, vol 85, Heft 1) reports having excised the mid-phalanx of the ring finger with its periosteum for sarcoma. He filled this defect by excising the first phalanx of the fourth left toe and transplanting this into the finger defect. The toe defect was filled by a graft from the tibia.

WITZEL (*Deut Zeit f Chir*, Bd 121, H 1, p 180) reports two successful cases in which he substituted a part of the clavicle, resected for sarcoma, by the spine of the scapula.

PELS-LEUSDEN (*Chir Operationslehre*, p 222) says that spina ventosa should be treated by excision of the diaphysis with its periosteum and the defect should be filled in with a graft taken from the tibia with its periosteum.

3 *Transplantation with pedunculated bone flaps, either temporary or permanent*. This method is mentioned for the sake of completeness. It is a great question whether it has any advantages over free bone transplants which are uniformly successful if periosteum be on the graft, and if asepsis be attained. Certainly the conditions will be rare in which pedunculated bone flaps are required.

A Ollier's operation *par renversement*. Expose the ends of the bone and excise the fibrous tissue between them. With a fine saw cut from one fragment a thin triangular slice of bone after freshening the opposite end. The slice of bone is hinged by the periosteum at the other end of the saw line. The triangular wedge of bone is now turned downward and its apex is sutured with chromic gut to the raw bone surface below, or it can be

anterior border with the convexity nearly at the posterior border, ending below at the anterior border again. The flap of skin is reflected off the periosteum beneath. A wide thin carpenter's chisel is as good an instrument as any to make the graft and there is no need of a more complicated circular motor saw. Measure the length of defect to be filled in and add to this sufficient length to dovetail each end into the corresponding medullary cavity of the fractured ends. With the chisel make transverse cuts at the anterior border of the tibia at each end of the part to be transplanted, one-half or three-quarters of an inch deep, the transplant being about as thick as one's forefinger. On the internal surface join the posterior end of each transverse cut by a longitudinal groove which is made by successive light blows of the mallet on the chisel directed outward, which is moved along after each blow. This is to prevent splintering of the graft. Proceed deeper, the chisel being moved along the groove after each blow. By a longitudinal incision divide the tibialis anticus from the external surface of the tibia without injury to the periosteum, which is longitudinally incised at a distance the same as on the internal surface. Join the posterior ends of the transverse incisions in the bone by a longitudinal groove made on the external surface, the chisel being directed inward through the incision in the periosteum. Proceed deeper until the chisel enters the medullary cavity, then go to the opposite groove and carry this likewise into the medullary cavity. The graft is lifted out by an instrument and is never touched by the gloved hand. The graft should be placed into the defect made for it just as quickly as possible that its cells may not die from lack of nourishment. It should not be placed in salt solution as this washes away the little blood that is left on the graft to nourish its cells. Murphy's method is to enlarge the medullary cavities of the fragments with a reamer or burr for a distance sufficient to form a good firm bed for the graft. An equally good method is to make longitudinal furrows opposite to each other on the stumps, large enough to receive the graft. Drill holes are made through the fragments and graft and chromic gut sutures

you are, to know that 90 per cent ¹ of the cases of cancer of the cervix are inoperable when first seen by a surgeon, that 90 per cent ² of gastric carcinomata are inoperable, the same with 29 per cent ³ of those in the breast, and, on account of its more rapid course, a larger number of cancers of the tongue and mouth? Mark you, I do not mean only that so many cases are unfavorable or fairly late ones, but are actually inoperable, in other words, without a reasonable chance of removing the disease. What does this mean to us as citizens of the United States where there are upward of 40,000 ⁴ deaths from cancer annually, and where, as in Great Britain, perhaps, one man in eleven and one woman in eight ⁵ dies of the disease?

Why it means that 15,000 at the least die of cancer of the stomach. How few are saved one is, for the cause of so heavily handicapped surgery, ashamed to state. In not a great many more is the slightest attempt made to save life, the most done being a palliative gastro-enterostomy. How many here have saved such a patient? Your essayist candidly admits that he has not rescued a single one, and does not expect to, unless it be by accident or fortuitous circumstance, until an entirely different order of things obtains. So long as gastric cancer is looked upon as a medical affection and treated as such until starvation threatens its host, when, only as a *dermier ressort* a surgeon is called in to assume the responsibility for a death which is no longer doubtful, but only a matter of time, just so long, I maintain, will surgery be impotent. Naturally the physician, nearly always through pride of opinion, waits until he can by symptoms, signs, test meals, skiagrams, etc., etc., make a positive diagnosis. When this can be done the case is no longer operable. We, as surgeons, know it, and yet keep on doing palliative operations, which may or may not palliate, but which certainly, at the very best, are only of temporary

¹ Childe

² Munroe and Bottomley

³ Halsted

⁴ Chris H Mayo

⁵ Roger Williams

pushed into the medulla As much as two inches of bone may be replaced by this method The periosteum is the permanent pedicle

B Ollier's operation par glissement Freshen the end of each fragment and remove the fibrous tissue From the upper end cut a triangular piece of bone with periosteum on it, but do not separate this portion of bone from its connections with the soft parts Slide this piece of bone downward and suture it to the end of the lower fragment

C Ollier's operation of implantation This is only suitable when one of two parallel bones is the site of a defect The sides of the ends of the fragments are obliquely vivified opposite the bone from which the transplant is to be taken These surfaces make two sides of a triangle From the opposite healthy bone a triangular piece of bone is cut which retains its connections with the soft parts The graft is turned and implanted into the defect, where it is sutured

D Muller's two operations The first is made by turning the flap which consists of skin, periosteum and bone, the pedicle being permanent The ends of the fragments are exposed by a vertical incision which projects upward and downward, covering half an inch of the surfaces of each fragment Remove all scar tissue interposed and freshen the ends and sides of the bone with a chisel On the surface of the upper fragment outline a tongue-shaped flap, cutting through the periosteum with the knife The pedicle consisting of skin is off to one side With a chisel introduced through the upper flap incision cut a slice of bone corresponding to the skin incision Rotate this flap so that it bridges the osseous defect and fasten the bone in the flap to the raw surfaces of the fragments with chromic gut Undermine the edges of the upper defect so as to bring them together, or close it by Thiersch's grafts

The second method by Muller is one in which the twisting of the pedicle is avoided Make a V-shaped incision, the open part of the V being about two inches below the end of the lower fragment and projecting upward the same distance in front of the upper fragment Carry the incision through the periosteum below and raise a slice of bone with the chisel from in front of the lower fragment Elevate the flap, expose the defect between the fragments, remove the fibrous tissue, vivify with the chisel the ends of the bones and the front of the upper fragment Carry the incision upward through the skin only on the surface of the upper fragment and loosen this part of the flap Draw the flaps up until the bone in the flap bridges the defect between the upper and lower fragments Suture the bone in this position Carry the incision upward until the redundant portion of the upper part of the flap can thus be smoothed out Undermine the edges of the lower defect and bring them together or Thiersch graft them This operation has given Muller, Sprengel, von Eiselsberg splendid results

These operations are not of frequent applicability If the defect be over 4 or 5 cm they will be impossible An objection which strikes me is the increased liability to infection, owing

superior extremity of the fibula with its periosteum, the head of which was placed in contact with the carpus. Intermedullary fixation of upper end of graft. Result in each case was splendid.

5 *Transplantation of periosteal flaps* (Codivilla's operation) Codivilla, after freshening the ends of the bone, unites them with a wire suture and envelops this suture with a free, detached flap of periosteum taken from any convenient bone, taking pains to shave off with the periosteum a thin shell of bone, but Brade used the periosteum alone and obtained a good result. It would seem to the author better to use an absorbable suture such as large chromic gut rather than wire between the bones. The internal surface of the tibia is a good location from which to get the periosteum. A thin slice of bone should be taken with the periosteum and attached to it.

6 *Transplantation for congenital absence of tibia* Halsted Myers (*Med Record*, July 15, 1905) operated as follows. The entire tibia was wanting but the fibula was intact and in its proper position. The outer half of the joint was incised, opening the articulation between the fibula and femur. The patella ligament, thin and strong, was found to be inserted into the inner side of the fibula well below the head. The external lateral ligament was divided. The head of the fibula was drawn down and into a position between the condyles. The patella ligament was shortened and attached to the anterior surface of the fibula. The articular capsule was sutured so as to aid in holding the head of the fibula in its new position. The wound at the knee was closed, after which the ankle was opened by a transverse incision, the external malleolus was cut off and the raw end of the fibula was planted on to the upper surface of the astragalus which was freshened by the chisel to receive it. The bones were sutured together. Immobilization. A year after the operation, the patient could flex his leg to 90°, almost fully extend it, and walked about all day.

7 *Transplantation of dead bone, either decalcified bone chips or large fragments* Senn's *decalcified bone chips* *Preparation of the chips* Remove all periosteum and medullary tissue from the fresh tibia or femur of the ox, divide into longitudinal strips about $\frac{1}{8}$ of an inch wide and immerse in a relatively large quantity of 10 per cent. watery solution of hydrochloric acid which should be renewed daily, for from one to two weeks, then wash thoroughly in water or a weak solution of caustic potash, cut into small chips, soak for forty-eight hours in 1 to 1000 mercuric bichloride solution, remove and store in a saturated solution of iodoform in ether. When about to be used, wrap in aseptic gauze, dissolve out the excess of ether and iodoform with alcohol and put in 1 to 2000 mercuric chloride solution until required, when careful drying with iodoform gauze should precede their implantation.

Technic—Fill the cavity completely or the defect between the ends of bone whose extremities have been previously freshened with the chips and allow blood to fill up the interstices between the chips. It is claimed that the bone chips strengthen the framework of blood-clot into which the healthy granulation tissue penetrates, while the iodoform disseminates through the blood clot which thus inhibits bacterial activity (?).

to the Thiersch grafts, or to tension of the sides of the defect, as well as to the small raw surfaces which are liable to be left at the sides.

Vulpus has cut a transplant from one of the fragments with a pedicle solely of periosteum, situated very near the pseudarthrosis. He then turns the graft 190° around on this pedicle and fixes it to the other fragment. A musculo-aponeurotic flap has been used, obtaining the transplant from a neighboring bone. Codivilla has transplanted a graft taken from the iliac crest upon the femur, twisted about a pedicle, taken from the gluteus maximus, and upon the humerus a graft taken from the external border of the scapula, nourished by a part of the external rotators of the shoulder. Bardenheuer in two cases has transplanted the spine of the scapula upon a pseudarthrosis of the humerus. These procedures seem complicated and unnecessary.

Hahn or Huntington's operation. This is suited to patients in whom there has been an extensive loss of tibia but the fibula remains intact. Through an appropriate incision (curved, across the leg at the level of the upper fragment), expose the under surface of the upper fragment and vivify it. Cut the fibula off at this level and insert its end into the under surface of the tibial upper fragment where it is fixed. Six months later, a second operation is done. Expose and vivify the upper surface of the lower fragment of the tibia. Divide the fibula at about the same level and unite its lower end to the fresh surface of the tibia. In some cases both operations have been done at one sitting.

A graft increases in size according to the demands put upon it. This is seen in the case of the above transplanted fibula which eventually increased in size to that of the tibia.

Bardenheuer in a defect in humerus made a tongue flap on chest. Subperiosteally resected a rib which was left attached to flap which was reflected into defect. Division of the bridges in two months. Good union.

4 *Transplantation combined with arthroplasty*. Rovsing excised a sarcoma from the upper end of the humerus and implanted a segment of the fibula. He excised the diseased bone from the humerus together with its periosteum and muscular attachments. He then exposed the upper end of the fibula through a longitudinal incision, retracting out of the way the uninjured external popliteal nerve. The superior tibiofibula articulation was opened and the ligaments divided. The fibula was then mobilized for a distance of 3 cm longer than the segment of humerus which was removed, by cutting the muscles arising from it, leaving a muscular sheath, about 1 cm thick, attached to it. The lower end of the fibula fragment was sharpened with a chisel and this was forced into the medullary cavity of the remaining diaphysis of the humerus. Sutured the remains of the articular capsule of the shoulder-joint about the upper end of the fibula and the soft parts of the arm to the muscular tissue left attached to the transplanted fibula.

Walther and also De Gouvea each resected the inferior extremity of the radius for sarcoma. Into the resulting defects each transplanted the

and resistance to infection, the mouth and face offer the best field for its use. In other parts of the body, sinuses may form which will persist, requiring the removal of the foreign material.

B Absorbable foreign materials such as ivory, magnesium plates, tubes, or columns have their uses in but a few situations in the body and can usually to advantage be replaced by living bone grafts taken from the same patient who is to be grafted.

Primrose implanted an ivory peg of suitable size and shape into a phalanx removed for a central enchondroma. Fourteen weeks later a roentgenogram showed the peg partially absorbed but surrounded by a satisfactory amount of bone. Possibly a better method would be to remove a phalanx from the patient's toe with its periosteum and transplant that, or else a small piece from the tibial crest with its periosteum.

9 *Transplantation of joints* In bony ankylosis of the elbow, Buchmann (*Zentralbl für Chir*, 1908, No 19) has devised what may be a valuable procedure. In two cases he transplanted the first metatarsophalangeal articulation into the elbow-joint. His procedure is as follows: A posterior longitudinal incision is made down to the triceps tendon and the olecranon. Divide all the soft parts longitudinally along the outer side of the olecranon. With an elevator, separate and push inward the triceps tendon, remnants of capsule and periosteum. Divide the olecranon at the level of the joint and the lateral remnants of the capsule. Divide the bony union between the humerus, radius and ulna. Flex the elbow and cut out from the trochlea a niche, wider in front than behind and narrower above than below. Remove a very thin slice from the lower end of the humerus. Separate the brachialis anticus from its insertion into the coronoid process. Cut a quadrangular niche in the ulnar epiphysis. Remove the head of the radius and separate the radius from the ulna. Excise the first metatarsophalangeal articulation without opening the joint itself. Remove with the joint sufficient of the metatarsus and phalanx to fit into the niches cut in the humerus and ulna. Implant the excised joint into the wound at the elbow in such a manner that its plantar surface faces backward. Fit the ends of the metatarsus and the phalanx into the corresponding niches cut in the humerus and ulna. Close the wound in the elbow, sewing all divided tissues back into their original normal positions. Immobilize in the extended position.

LEXER (*Archiv f kl Chir*, vol 86, p 852), in 1908, described two cases in which he transplanted the entire knee-joint. The difficulty in obtaining a knee-joint to transplant will undoubtedly prevent the surgeon from frequently imitating this procedure. Lexer warns against obtaining a knee-joint from a cadaver since, in one of his cases, there was so great a formation of connective tissue, that the graft had to be removed on account of lack of motion. The graft will have to be obtained from a freshly amputated extremity, removed for senile gangrene (without phlegmon) or for paralysis. Those interested should consult the original article.

Transplantation of large fragments of dead bone This method has given some successes

Kausch, after removing the upper end of the tibia for sarcoma, implanted a corresponding portion of the tibia obtained some days previously in the course of an amputation The implant was deprived of its periosteum and marrow, was carefully boiled and soaked in ether to remove its fat An amputation, nine months after the transplantation, for recurrence of the sarcoma, showed the implant firmly united both to the femur and tibia and enveloped in a new formed periosteum Kuttner excised the upper third of the femur for sarcoma and at once implanted a similar portion of the femur, obtained from a man who died of coma, due to tumor of the brain The upper end of the femur along with its head was removed under aseptic precautions, eleven hours after death, and was preserved for twenty-four hours in salt solution, to which some chloroform had been added Six weeks later the result was promising Brewer, of New York, removed the entire lower third of the radius with its periosteum for sarcoma A few days later a suicide was brought into the hospital, where he died The corresponding radius was dissected out, of just sufficient length to fill the defect This bone was then boiled and kept for several days in sterile salt solution, when the original wound was reopened and the graft was implanted The soft parts were sutured around it Union was by primary intention Several months afterward the transplant showed a moth-eaten appearance, as though it were absorbing One year later the man had a very useful forearm and hand At the junction of the graft with the old shaft there was some bowing but union was solid Roentgenograms showed that the old graft had largely become absorbed but that it had been replaced by new firm bone The result was very satisfactory

How many non-successes have followed this method, no one can say. Surgeons are not inclined to publish their non-successes, hence the investigator can scarcely arrive at an unprejudiced judgment of the true value of any particular method

A better method for the above would seem to be as follows Walther (*Bull et mem de la Soc de Paris*, vol 37, No 20) resected the inferior extremity of the radius for sarcoma similar to Brewer's case above Into the defect he transplanted the superior extremity of the fibula with its periosteum, the head of which was applied on the carpus Intermedullary fixation of upper end of graft Result was fine.

De Gouvea (*La Presse Medicale*, July 17, 1912) performed an exactly similar operation to the preceding with a successful result

8 *Transplantation of absorbable or non-absorbable foreign material*
A Non-absorbable material Murphy and numerous German surgeons have implanted into a defect in the lower jaw made for the removal of malignant tumors, a silver wire model with a metal head of normal size and shape of the mandible In Murphy's case suppuration occurred around the frame-work, since it communicated with the mouth, and a profuse discharge was present for six weeks, when it ceased entirely The sinus healed and the frame-work became completely imbedded Three years later there was no sinus present and the function was good Because of its vascularity

the anterior surface of the patella fragments of periosteum over an area about one inch square on each side of the line of fracture. Expose the crest of the tibia and chisel off from its inner surface a quadrilateral plate $1\frac{1}{2}$ inches long by $\frac{3}{4}$ inch wide by $\frac{1}{8}$ inch thick. Leave its periosteum undetached.

Place this with its raw surface in apposition with the denuded area in front of the patella. Unite the fragments by a figure-eight suture of chromicized catgut or kangaroo tendon, which grasps the ligamentum patellæ and quadriceps tendon immediately below and above the broken bone and crosses in front of the transplant. The periosteum, which was previously turned back from the patella, is next drawn up to, or over, the transplant with a couple of catgut sutures. The skin incisions are closed by a subcuticular catgut stitch, and the limb enclosed in a plaster-of-Paris case splint for four or five weeks.

CASE I—*"Refracture" of the patella* Miss A. L., age thirty-four, fell down stairs and sustained a fracture of the right patella on November 1, 1912. I sutured this in the usual way in St. Francis Hospital on November 4, 1912. The splint was worn eight weeks and there was an apparently perfect result.

On February 10, 1913, she slipped on some ice and, without falling, felt something snap. She then walked to the Hospital and the patella was found to be fractured exactly as before. On February 17, under ether the operation described above was carried out. The suture material to retain the bones in position was chromicized catgut. The case splint was worn subsequently for only four weeks. Complete flexion of the joint was possible at the end of about nine weeks. The radiographs show the transplant at the end of three weeks, six weeks and thirty-two weeks (Figs. 1, 2 and 3).

CASE II—*Ununited fracture of the patella* Mr. L. S., age forty-four, sustained a fracture of the left patella (by muscular violence) on January 22, 1913. It was treated only by strapping and immobilization for six weeks. He then entered Bellevue Hospital for relief of the weakness in the leg. He was unable to raise the foot from the bed while in a horizontal position. There seemed to be a weak band of fibrous tissue between the fragments which were one inch apart.

AUTOGENOUS BONE GRAFTING FOR FRACTURE OF THE PATELLA.

BY JOHN ROGERS, M.D.,

OF NEW YORK,

Surgeon to Bellevue and St. Francis Hospitals

THE usual method of treatment for these injuries consists in exposing the fragments and uniting them by absorbable or non-absorbable sutures. The advantages of absorbable or non-absorbable suture material seem still debatable, with opinion more in favor of chromicized catgut or kangaroo tendon than of bronze or silver wire.

The degree of separability of the fragments depends upon the amount of laceration of the capsule and fibrous tissue in continuity with the line of fracture. Unless these lacerations are repaired when the fragments are sutured, muscular contraction may interfere with bony union no matter what material is used to hold the bones in apposition, and no matter how carefully clots and fibrous fragments are removed from between the bones.

A not uncommon accident after operation in spite of every precaution, is a refracture from apparently insignificant violence. Fibrous union with separation of the fragments and greater or less disability in the injured extremity is probably a more frequent bad result.

To remedy either of these conditions it is suggested that an autogenous bone graft be taken from the crest of the patient's tibia and implanted on the front of the patella to bridge the line of fracture. Similar treatment is applicable to certain fractures of the olecranon.

Operation to Relieve Disabling Fibrous Union of the Patella, or to Cure "Refracture" of the Patella—Make a U-shaped flap, with the apex of the convexity over the ligamentum patellæ and the extremities over the condyles of the femur, suture the lateral rents in the fibrous capsule. Denude

FIG 3



CASE I A L Taken October 6 1913

CASE II L S Ununited fracture of patella
This shows the position of the fragments six weeks
after the injury on admission to Bellevue Hospital



FIG. 1

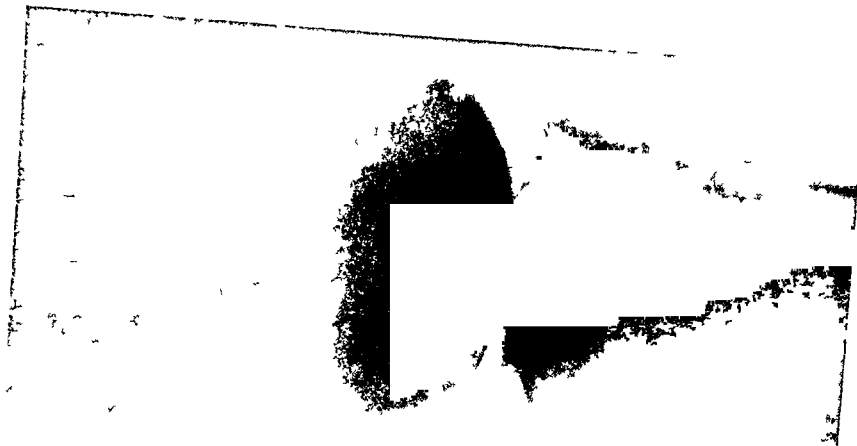


2 0 4
HOSH
YIN

CASE I A L. Taken April 5 1913

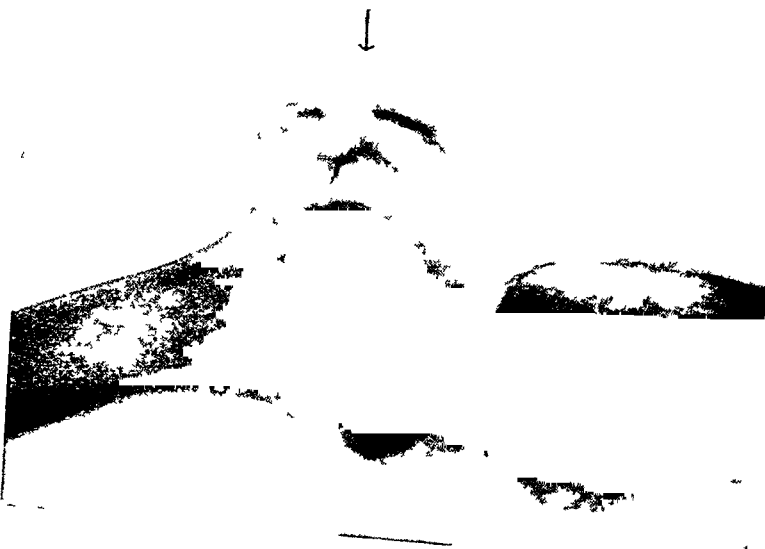
CASE I A L. Refracture of patella. This occurred February 10, 1913 and the bone graft was inserted February 17. Radiograph taken March 15 1913

FIG 4



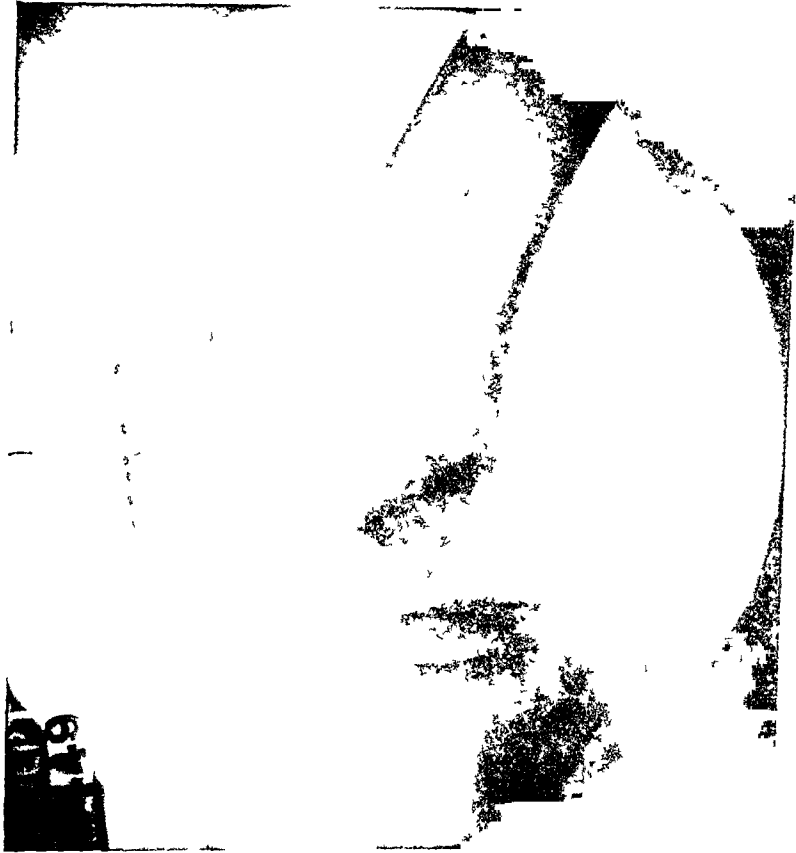
CASE II L S Ununited fracture of patella
This shows the position of the fragments six weeks
after the injury on admission to Bellevue Hospital

FIG 3



CASE I A L Taken October 6 1913

FIG 5



CASE II L S Showing the autogenous bone graft in position August 1, nineteen cels
after its insertion There is a perfect functional result

FIG 5



CASE II L S Showing the autogenous bone graft in position August 1, nineteen weeks after its insertion There is a perfect functional result

benefit, while their deterrent effect upon others with operable conditions is far-reaching and permanent. To them their friend or acquaintance died, not from cancer, but an operation; hence they themselves will have none of it.

When it is realized that the situation is about as bad in uterine cancer, not much better in cancer of the mouth and tongue, and only somewhat better in mammary carcinoma, then I say that it is time for surgeons to teach, write and act collectively and in unison. Operations upon advanced cases of carcinoma should neither be practised nor sanctioned, unless for the best of reasons. We have all, through a mistaken sense of duty to the patient in hand, performed useless, or worse, harmful operations, and in every such instance have increased the croakings of the pessimist, in and out of the profession, and unconsciously made it more difficult to rescue the operative surgery of malignant disease from that obloquy which now rightfully rests upon it as a whole. The results of individual operators, in particular regions to which they have given special attention, have done something, it is true, to inspire hope, if not to create a justifiable optimism concerning a disease that, not so very long ago, was looked upon, no matter where situated and with or without operation, as hopeless. But, as intimated above, and the argument is frequently used and pressed home, has not the patient a right to demand the slim chance of cure that has been held out to him, even when the surgeon of experience feels assured there is no chance at all? I unhesitatingly answer in the negative and for the following reasons, though of course I wish it clearly understood that by advanced I mean inoperable and not border-line or doubtful cases. By inoperable, to repeat, we mean a condition no longer local, but general, and one which cannot therefore, with reasonable certainty be extirpated on account of metastases to adjacent or distant tissues or organs. In the first place your essayist does not hesitate to affirm that he has little faith in the spontaneous recession of a carcinomatous growth after incomplete removal as he has seen no such result in any of the many operations he has himself done, assisted in, or seen others do, after a

On March 19, 1913, under ether, the operation described above was carried out. The upper fragment was bound close to the femur by much fibrous tissue, which required very free division before the loosened bone could be brought even near to the lower fragment. Complete contact could not be secured. The suture material to retain the bones in position was chromicized catgut. A case splint of plaster of Paris was worn for six weeks. The result has been perfect restoration of function. The radiographs (Figs 4 and 5) show the transplant nineteen weeks after its insertion.

It was noted in these cases that the fibula when fractured had united. If these patients have been previously operated on or if there is much laceration of the skin at the time of the accident, the difficulties in operating are greater. This scar which is closely adherent to the bone, poorly nourished and deprived of subcutaneous tissue, is liable to slough after being lifted up, a complication which occurred in two of our cases. No infection followed but careful dressings were necessary after the slough had separated until healthy granulations appeared.

In the treatment of cases of ununited fractures, enough bone for transplantation can be obtained from the same leg, thereby greatly shortening the patient's stay in bed. The transplanted bone will live if the following conditions are fulfilled: (1) The observation of asepsis, (2) if bone be obtained from the same individual; (3) securing a free supply of blood in the new habitat; (4) maintaining a reasonable amount of bony contact.

This procedure is not recommended for the infected case, although some surgeons have transplanted bone with infection present and obtained good results. When infection is present the bone to be transplanted should first be removed from the other leg and all work completed on this leg before the infected member is touched.

The question here arises: When are we to transplant bone for fractures which have not united? Robert Jones² speaks of the condition as "delayed union." This is a better nomenclature than "non-union" since it is probable that all of these fractures would unite in time. However, with the present-day advantages of surgery an operation for this condition may be advised, thereby saving time for the individual and an earlier return to his wage-earning capacity.

There can be no definite period assigned for transplanting bone in these cases of delayed union. Many factors should be considered, but the chief aim of the surgeon is to restore the individual to his duties at the earliest possible period.

² *Amer Jour. Orthop Surg*, October, 1913

THE TREATMENT OF UNUNITED FRACTURES OF THE TIBIA BY THE TRANSPLANTATION OF BONE.

BY M S HENDERSON, M B (Tor),
OF ROCHESTER, MINN
Mayo Clinic

UNUNITED fractures of the tibia are relatively common, especially in the middle and lower third of the bone. It is true that we do not see cases of such long duration as those of ununited fractures of the humerus which may be of five and ten years' standing. In one case, recently operated on in the Mayo Clinic, the humerus had been ununited for fourteen years. An arm thus partially disabled is infinitely more useful than an artificial arm and is not, therefore, sacrificed. On the other hand, an ununited fracture of the tibia necessitates the use of crutches or, for a laboring man, complete cessation of work. In such cases an artificial limb is more useful and therefore the legs are sometimes amputated.

The ingenuity of the surgeon has been greatly tried in the treatment of these cases. Many procedures have been advocated, prominent among which, of late years, have been the silver wire and the metal plate. The plate is best suited for certain recent fractures in the tibia in which apposition of the fragments cannot be maintained in any other manner. A perfect anatomic reposition of the fragments is not essential for excellent function. A little displacement is permissible if the axis of the line of weight-bearing in each fragment is parallel, but weight-bearing through an angle is bad, particularly if the fracture be near the joint.

Transplantation of bone into the tibia gives excellent results and the method herein described is so simple and reasonable that it must inevitably supersede the use of the plate or other mechanical devices in the majority of cases.¹

¹ In describing this method the author makes no claim for originality. Others have used practically the same procedures. Buchanan published an article and reported a case (*International Journal of Surgery*, October, 1912).

the wound. These sutures were tracted every day, thus causing a little motion of the plug. In this way, a mild irritative osteitis was kept up which was conducive to osteogenesis and the formation of callus. This ivory plug usually healed in, but occasionally disintegrated and came out in small pieces.

If transplants are taken from the opposite tibia, patients must be kept off their feet for a month or more. It is much simpler to take the bone from the same tibia, either above or below the fracture and get our patients up within a few days. The bone should preferably be taken from the flat internal surface of the tibia rather than from the crest which is dense, strong, and being the apex of a triangle, serves a most important weight-bearing function. A piece of bone removed from here down to the medullary cavity weakens the bone out of all proportion to the size of the piece removed. The bone on the internal surface is not so dense and is also more vascular and a large piece may be removed here without greatly weakening the bone. All the layers, *i e*, periosteum, cortex and medullary lining, should be included in the transplant.

In studying these pieces of transplanted bone by a series of X-ray pictures after their implantation, it is apparent that they live and functionate without being replaced by new bone. In the tibia, by forming a gutter down to the medullary cavity, the transplant can be placed so that periosteum meets periosteum, cortex meets cortex and medullary lining meets medullary lining, thus obtaining an anatomic approximation favorable to rapid healing.

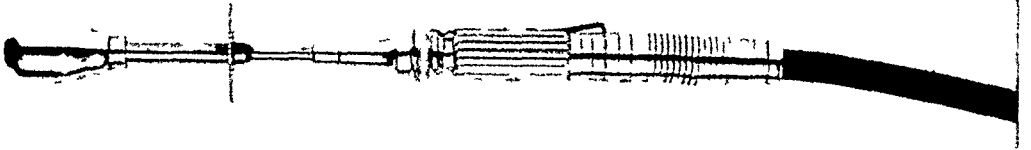
The technic of the operation, as followed in our more recent cases, is simple and may best be shown by the diagram (Fig 1). Either by the aid of the chisel or the motor-propelled circular saw (Fig 2), a piece of bone is removed from the internal flat surface of the tibia. The bone should be of sufficient length to make a substantial bridge, usually 2 or 3 inches long and about $\frac{1}{2}$ inch in breadth, and should include all the layers. This is taken from the longer fragment. A piece the same width in the same line is then removed from the smaller fragment. This is saved. The larger piece of trans-

There is generally but little deformity in the fractured tibia and good alignment and position may usually be maintained by the aid of plaster-of-Paris casts or splints. It is difficult to understand why union should not take place in these cases. The type of cases under consideration in this paper does not include the so-called Pott's fracture. Here it is true that the tibia enters into the question, but non-union rarely results and these patients usually seek relief because of faulty alignment which so intimately involves the ankle-joint as to demand correction.

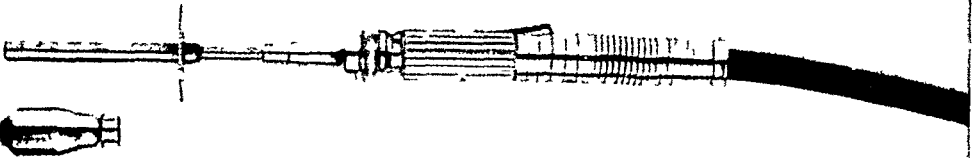
The 9 cases herewith reported were all healthy young males—one a boy 8 years of age. Syphilis was present in but one, and this was contracted after the leg had been broken one year. In the series of 9 cases, 6 were simple fractures and 3 were compound fractures. One of the latter had become infected. The other two, although the bones protruded at the time of the accident, had healed without any signs of infection. It does not seem probable that infection had any bearing on the delay in union.

The bone in these cases is especially adapted to transplantation since it is easily accessible, the operative field being just beneath the skin. The transplant will not have to hold the alignment because this can readily be done by external means. The fibula, which is intact or firmly united, maintains the length of the limb and no slipping-by of the fragments is likely to occur. The transplanted bone may be placed in a normal field, it is not necessary to put it in the medullary cavity. A gutter is chiselled or sawed in the fragments down to the medulla, thus allowing the transplant to have a natural bed to rest in. If a piece of cortical bone is used as a medullary plug it acts merely as a foreign body. It is, however, an absorbable foreign body and gradually disappears. During its absorption, osteogenesis is promoted, which leads to union. In operating on cases of ununited fractures of the humerus, 25 years ago, C. H. Mayo used an ordinary cataract bone knife-handle to make an intramedullary plug. He fastened linen sutures to its centre, leaving long ends, and brought these out through

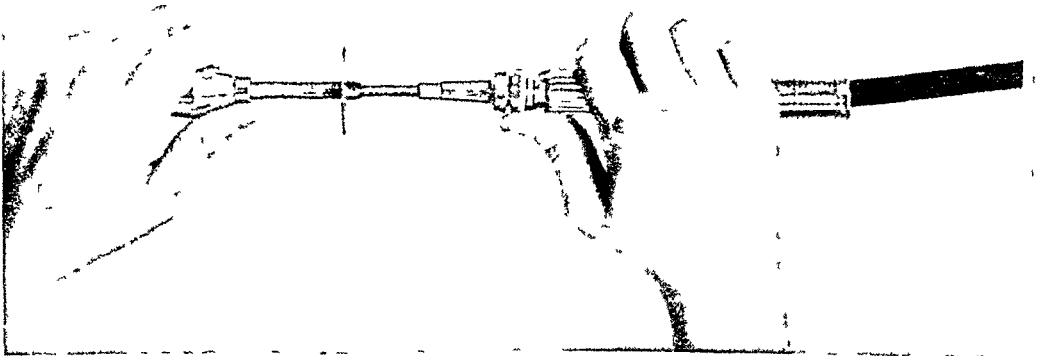
FIG 2



a



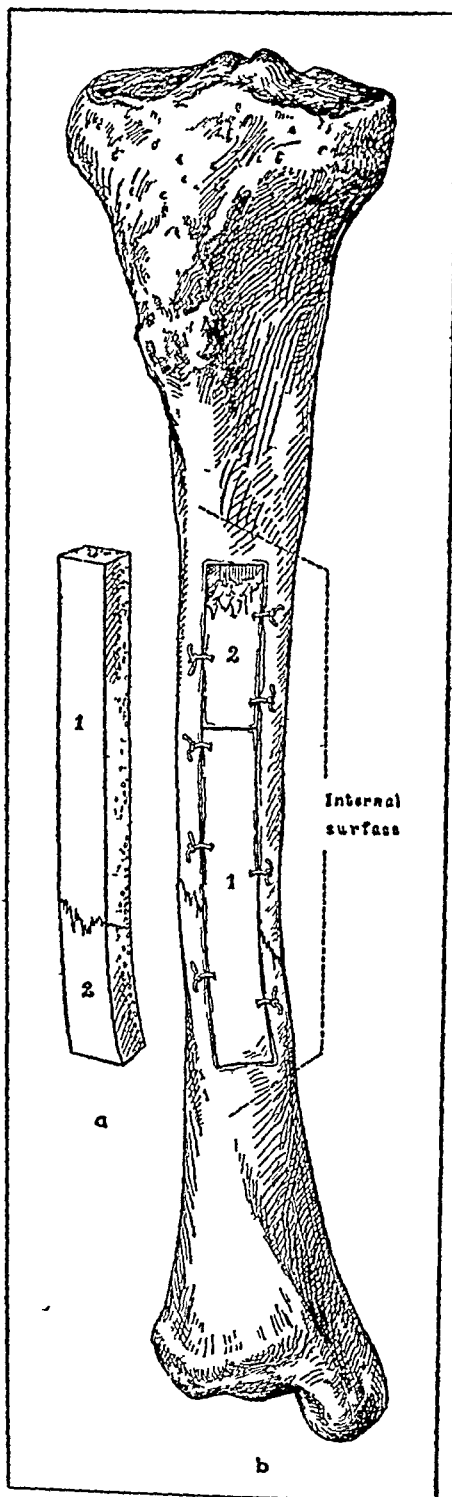
b



c

a type of circular saw used. Note removable metal cap on distal end of shaft. In using the saw the tip of the shaft which fits into this cap should be greased with sterile vaseline to prevent it becoming too hot to hold. All the metal can be dry sterilized. The flexible shaft is wrapped with a sterile bandage. *b* shows metal cap removed. *c* shows method of holding saw which gives the operator easy control.

FIG 1.



1a shows diagram of transplant removed from the long fragment, 2a shows transplant removed from the short fragment. 1b shows inversion of long transplant to bridge fracture, 2b shows short transplant inserted to fill gap left by removal of transplant from long fragment. Catgut sutures in periosteum of graft and shaft.

fairly large experience of the disease in more than thirty years of practice. Nearly, if not all, of such instances can be more rationally explained by a modern and enlightened pathology. A majority of them were abdominal growths and, moreover, were sarcomata. Sarcoma is a less stable growth than carcinoma and one can more readily believe, even though he does not comprehend how and why, that such neoplasms may, in some mysterious manner, undergo retrogression after a rapid, active, even luxuriant growth. I have never known spontaneous recession of a sarcoma to occur, but have seen it take place after free use of X-rays and Coley's toxins in a few instances. In most of these, again, the mass underwent retrograde changes only temporarily, later on to resume an unwonted activity and destroy its victim. But as diminution often, and seemingly complete disappearance occasionally, has occurred coincident with the use of various non-operative measures, I am willing to admit that it may follow incomplete removal by the knife. But every surgeon of experience must admit that nearly always the more active varieties of sarcomata, the large spindle and small round-celled varieties, the latter particularly, are made worse and life is shortened by incomplete removal. In such circumstances a masterful inactivity on the surgeon's part is best.

It is now accepted that gastric ulcers, diverticulitis, pericæcal inflammations, and benign tumors undergoing inflammatory action so closely at times mimic malignancy as to baffle the most experienced and observant surgeons. Consequent upon and with the appreciation of this fact, few instances of supposed cure have followed exploratory and incomplete operations for abdominal cancer, and fewer still are likely to be reported subsequently. This is a day for cold, hard facts, and not for the perpetuation of surgical vagaries that had birth in the fancy of observers who, however able, were not possessed of the means now employed and accessible to all.

Further, even if I could be convinced that occasionally an undoubtedly carcinomatous mass may in some strange, vague and inexplicable manner pass away, I should still look

FIG 3



Ununited fracture of lower $\frac{1}{2}$ of left tibia 1 $\frac{1}{2}$ years after injury

FIG 5



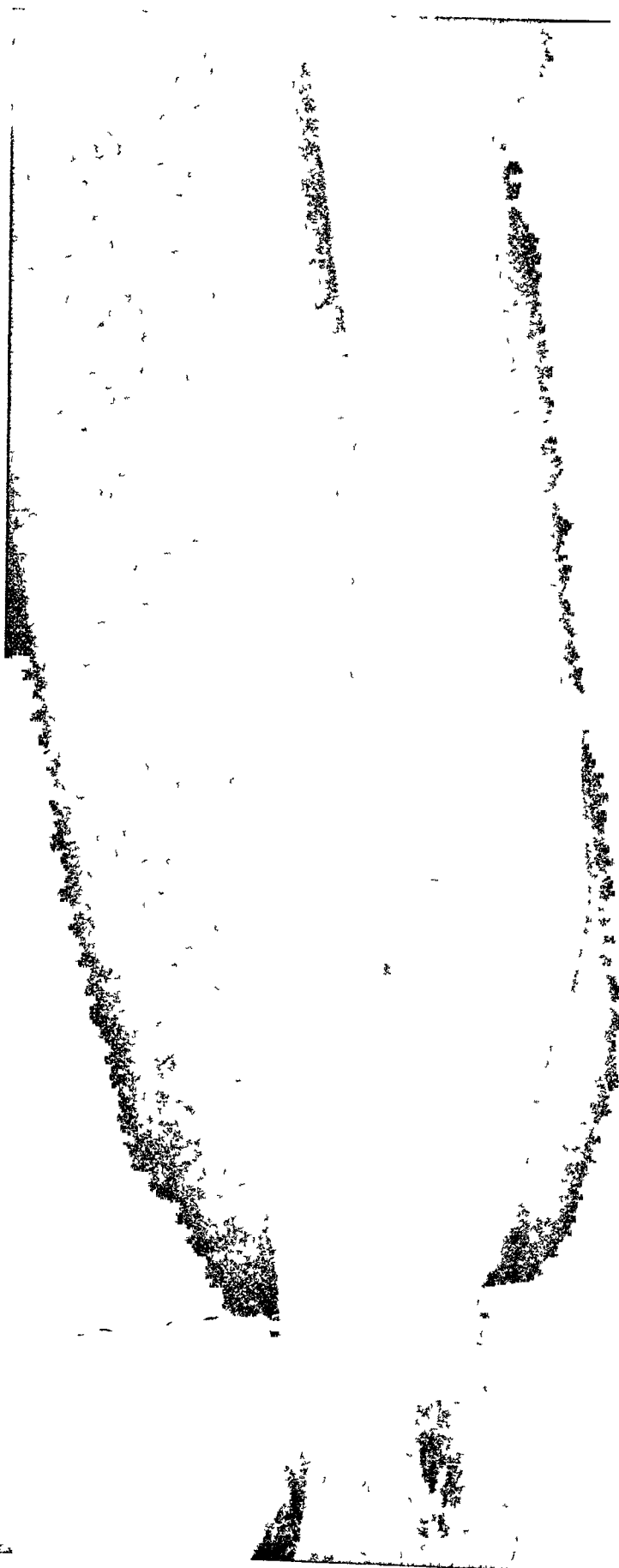
Non-union after 1½ years

FIG 6



Shows transplant used to bridge the fracture. Silver wire was used contrary to our late technic, also the transplant was removed from the crest and not from the flat internal surface

FIG 4



Shows transplant used to bridge fracture in one of our early cases. The transplant was removed from the crest of the tibia and not from the internal flat surface

Operation—On January 6, 1913, the fracture was exposed and a piece of bone four inches long transplanted from the middle third of the same tibia to bridge the fracture (Fig 4) Healing occurred by first intention On May 15, the patient resumed his full duties on the farm Probably firm union had existed for 6 weeks prior to that time

CASE A78224—X-ray 18668 Male, aged twenty-eight Miner Examination January 7, 1913 Delayed union of fracture of the middle third of right tibia, 1½ years' duration There was free motion at site of fracture Two crutches were used Amputation had been advised by home physicians

Operation—On January 9, 1913, bone was transplanted from the same tibia to bridge the fracture Instead of using catgut as usual, aluminum bronze wire was used A scar which was the result of the original accident sloughed after being lifted up at the operation Under alcohol dressings this surface granulated and healed without infection The patient did not resume his full duties until September 2, 1913 He wrote that the leg was strong before that time but he was afraid to use it A medicolegal question in this case may have prolonged the convalescence

CASE A80259—X-ray 19480 Male, aged thirty-two Laborer Weight 200 pounds Examined in the Mayo Clinic February 19, 1913 One year previous, he had sustained a simple fracture in the upper third of left tibia There was delayed union, and at the end of 6 months the fracture was wired, but without resulting union When he came for examination, he was still using two crutches

Operation—On February 22, 1913, a transplantation was done on the same tibia to bridge the fracture Primary healing followed and the patient was dismissed with a leather-sheath brace and crutches On May 11, 1913, he slipped, throwing all his weight on the fractured leg There was an injury and he returned for treatment X-ray disclosed a new fracture which had occurred at the point where the upper end of the transplant had been removed The old fracture was intact A plaster-of-Paris cast was applied The patient resumed his work on November 20, 1913, and reports the leg to be solid and straight

CASE A82916—X-ray 20710 Male, aged thirty-four Laborer This patient was examined April 16, 1913 Nine months previous to the examination, he had sustained a simple fracture

plant is then inverted so that sound bone will bridge the line of the fracture. The part which was the upper end fits into the angle distal to the fracture in the smaller fragment. The piece removed from the smaller fragment is then used to fill the remaining gap in the longer fragment. Both pieces are sewed in by stitching the periosteum of the transplant to the periosteum of the shaft. The skin is then closed with silk-worm and horse-hair and the dressing applied. A plaster-of-Paris cast is applied to include the knee and ankle. This is removed at the end of two weeks. Sutures are removed and a new cast put on which is left for from 4 to 6 weeks. Further treatment is guided by the individual case. Union is usually firm enough to permit walking in from 3 to 6 months.

CASE A71534—X-ray 16559 Male, aged thirty-one Mining engineer. Date of examination in Mayo Clinic August 2, 1912. Twenty-six months previous to examination, the man had sustained a compound fracture in the lower third of the tibia and fibula. No infection followed. In spite of good treatment by cast, splint and brace, there was but little union and that was fibrous. In October of 1911, he contracted syphilis, which was treated promptly and effectively. At the time of examination in our clinic, although he had had no treatment for 2 months, his Wassermann was negative. He was walking with the aid of a brace but had been unable to resume work.

Operation—On August 12, 1912, the fracture was exposed and a transplant was moved down from above to bridge the fracture. Healing by first intention followed and the patient was dismissed. Three months later he wrote that the union was firm and asked permission to bear weight on his leg. This he was advised to do gradually.

CASE A78083—X-ray 18621 Male, aged thirty Farmer. Date of examination January 3, 1913. Patient presented himself for examination because of delayed union of a compound fracture of the left tibia of 1½ years' standing. Infection followed and he was quite ill for 2 months. At the time of examination in our clinic, there were no signs of infection. He had been treated by splints and casts. The union was entirely fibrous, there being free motion at the site of the fracture, and he was using two crutches (Fig. 3).

Farmer Examination June 16, 1913 Two months previous had sustained fracture of the lower third of the left tibia There was slight anterior displacement of the lower fragment and non-union

Operation—On July 17, 1913, a transplantation was done from the same tibia to bridge the fracture which was comminuted A letter from the patient dated December 11, 1913, states that he is walking with a cane The convalescence was slow in this case, largely because of trauma at the time of the fracture There was much swelling of the soft tissues, even two months after the fracture occurred

CASE A97369—Male, aged twenty-two Chauffeur Examined December 17, 1913 On November 25, 1911, he fractured lower third of right tibia and was treated by splints, casts, etc., until May, 1912, when an operation was performed Bone transplant and silver wire were used No union resulted

Operation—On December 23, 1913, in the Mayo Clinic a piece of bone 4 inches long was removed from the middle third of the tibia and used as a transplant to bridge the fracture The wound healed by first intention

in the middle third of the right tibia and fibula. Casts and splints were used. After four months, he was operated on for delayed union by his home physician. Silver wire was used. No union resulted and his physician referred him to the Mayo Clinic for treatment. He was on crutches.

Operation—On April 19, 1913, the fracture was opened and a portion from the same tibia transplanted to bridge the fracture. Primary healing occurred. On October 27, 1913, the patient resumed his full duties and in a recent letter stated that he had walked 10 miles.

CASE A82640—X-ray 20553. Male, aged eight. Date of examination April 9, 1913. Five and one-half years previously had sustained fracture of the middle third of the right tibia. Malposition and imperfect union resulted. Two years ago he sprained his right ankle and examination by the X-ray disclosed non-union of the tibia. It was wired but no union resulted. In August, 1911, a Lane plate was applied but infection followed, and in November, 1911, the plate was removed. Following the removal of the plate the leg seemed to become perfectly straight and quite solid but at about the eighth month, though the leg was straight, there was motion at the site of the fracture. The union became gradually weaker with more motion and the deformity steadily increased. High shoes had been worn to come up over the fracture for more than a year.

Operation—On April 9, 1913, bone was transplanted, the transplant being obtained from the same tibia. There was a slough of the skin, the result of the poorly nourished old scar, but no infection occurred and the patient's recovery was uneventful. A recent letter states that he is running and playing without any support and the leg seems perfectly solid.

CASE A87500—X-ray 22915. Male, aged thirty-two. Farmer. Examination July 9, 1913. On May 12, 1913, he sustained a compound fracture of the left tibia and of the middle third of the fibula. No infection followed. No union other than fibrous occurred. The fibula had united.

Operation—On July 11, 1913, bone was transplanted from the same tibia to bridge the fracture. The healing and convalescence were uneventful. The patient resumed full duties by November 1, 1913, the leg being perfectly firm and solid.

CASE A89982—X-ray 22221. Male, aged forty-eight

worm-gut sutures No evidence of infection on grafted side At the end of four weeks patient was up and about on crutches Recovery so far uneventful February 10, 1913, walks about ward on his cast without pain Bony union

CASE II—Patient, L J, a German laborer, forty-seven years old, suffered a comminuted fracture of the left tibia and fibula, and a comminuted fracture of the left radius, as a result of a railway accident December 10, 1912 At the time of his admission to the Swedish Hospital it was noted that his body was covered with syphilitic rupia This disappeared under mercury and large doses of potassium iodide in two weeks An anæsthetic was given and his fractures reduced A splint was applied to the forearm and a well-fitting plaster case to the leg The arm united nicely The leg, however, failed to show any evidence of bony union after eight weeks, and an operation was decided upon This was performed January 28, 1913, at the City Hospital, under ether anæsthesia A longitudinal incision seven inches long was made, just to the inner side of the crest of the tibia The ends of the bone, while in good apposition, were not united but were covered with granulation tissue A loose fragment, about one inch long, was detached from the posterior portion of the upper fragment Owing to the great irregularity of the broken bone, the ends were cut off with a chain saw and the granulation tissue in the medullary cavity was reamed out for a distance of about two inches The crest of the opposite tibia was now laid bare and a piece of bone about five inches long was removed This was detached with the chisel after the crest had been cut to the required depth at either end with the saw No attempt was made to remove the periosteum from the transplant This was now immediately driven into the reamed out end of the lower fragment Traction was made upon the leg and this large bone peg was inserted into the upper fragment and the bones brought into accurate apposition A small nail was driven into the upper end in order to keep the transplant in place The muscles and fascia were brought together with a few catgut sutures and the wound closed without drainage The leg was put up in a plaster case Primary union resulted Six weeks later firm bony union had resulted

CASE III—H E C, General Hospital, carpenter, broke his tibia and fibula, about middle, by a fall from a scaffold No union

THE TREATMENT OF UNUNITED FRACTURES OF THE TIBIA BY BONE TRANSPLANTS.

A REPORT OF FIVE TRANSPLANTATIONS WITH FIRM BONY UNION

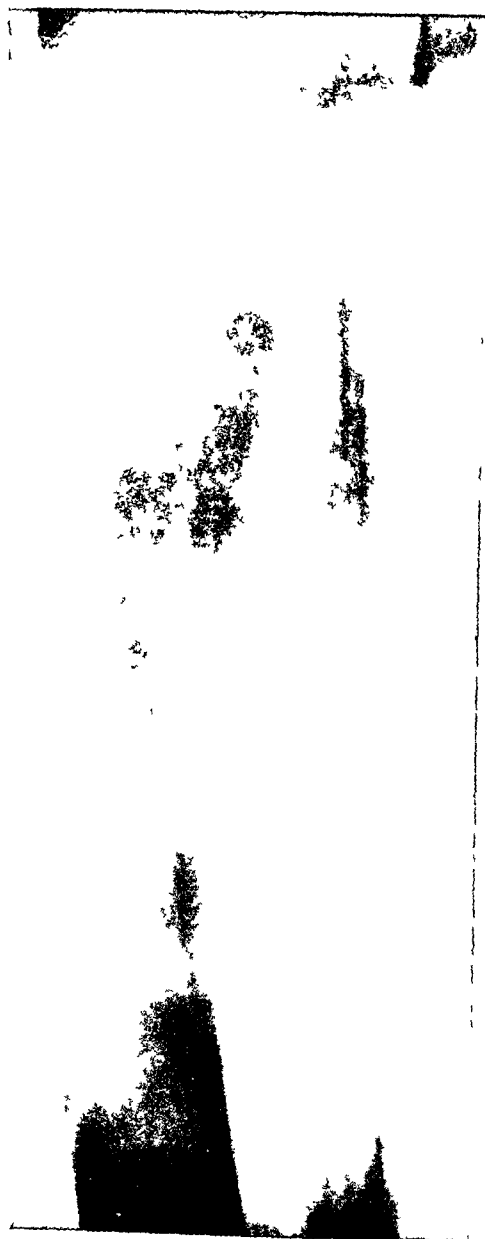
BY ERNEST F. ROBINSON, M.D.,

OF KANSAS CITY, MO

WITHIN the past twelve months five cases of ununited fracture of the tibia have been treated by me by the transplantation of bone with such uniform success and so little mechanical difficulty, that I desire to place them on record as a demonstration of what I believe to be the best and only certain method of securing union in this class of most obstinate and often almost hopeless injuries

CASE I—Patient, A. S., a Russian laborer forty years old, entered the General Hospital, November 27, 1912, with comminuted fracture of both bones of the left leg. The X-ray demonstrated displacement of a large fragment of bone of the tibial fracture with shortening of both bones. Fracture of both bones was in upper third. The limb was immobilized temporarily in blanket splint for three days and then in light plaster case. Limb was left immobilized for six weeks with occasional massage and passive movement. At the end of this time the deformity due to misplacement was easily palpable and limb was movable at point of fracture. The second X-ray at this time exhibited very little callus formation and no bony union. Open operation, January 14, 1913. Ends of tibial fracture were exposed and sawed so that they could be placed in apposition with no deformity. A piece of bone five and one-half inches long was removed from opposite tibia and introduced into medulla of ends of fractured tibia and approximated. Wound repaired and limb placed in plaster case immediately. For a week after the operation patient's temperature varied from 100° to 100.4°, pulse averaging 100. The sound limb was redressed at end of six days. Slight infection of surface wound was found. After this redressing, temperature and pulse have been normal. Silk-

FIG 3



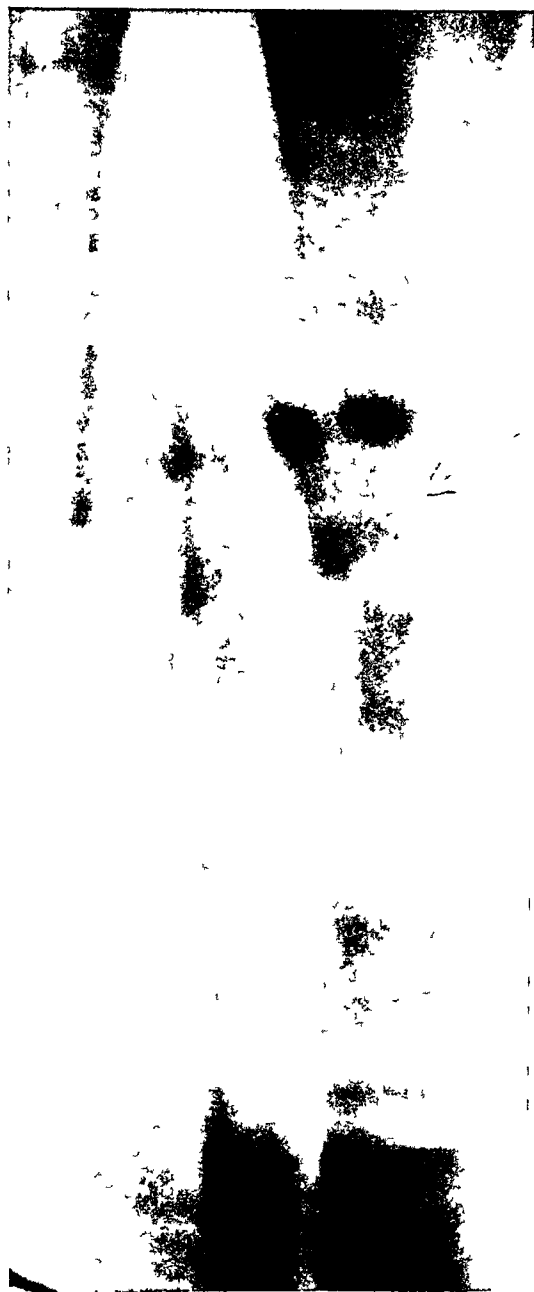
Bone transplant for ununited fracture of tibia
(Case III)

FIG 4



Bone transplant for ununited fracture of tibia
(Case IV)

FIG 1



Bone transplant for ununited fracture of tibia
(Case I)

FIG 2



Bone transplant for ununited fracture of tibia
(Case II)

after nine weeks. Operation December 30, 1913. Incision four and one-half inches, slightly curved just to outer side of tibial crest. Several small fragments of bone removed from between the ends of the broken shaft. A transplant about four inches long by one-half by one-half inch was cut from the crest of the opposite tibia with a chisel and saw. This was inserted into the reamed out ends of the upper and lower fragments and the bones brought accurately together. A plaster case was applied. After ten days this was replaced by another, correcting the slight deformity shown in the X-ray picture. Firm bony union resulted.

CASE IV—C. W., a mulatto thirty-five years old, laborer, suffered a comminuted fracture of the right tibia as a result of a fall in July, 1913. Dr. Carbaugh reduced the fracture and retained it in good position by splints and later a plaster case. Ten weeks after the accident, however, only fibrous union had taken place. September 21, 1913, he was taken to the hospital. Under ether anæsthesia an incision five inches long was made just to the outer side of the crest of the tibia. Fibrous tissue and muscle fibre was found between the ends of the broken bones. The ends of the fragments were cut off with a chain saw, both bones were reamed out for a distance of two and one-half inches with a Murphy reamer. A bone transplant about four and one-half inches long and one-half inch wide and thick was removed from the crest of the opposite tibia. This was easily and quickly accomplished by a Hey's saw and chisels. It was doubly clamped to avoid the danger of dropping it. The transplant was then driven into the reamed out end of the upper fragment and aided by extension pushed into the lower fragment. This held the bones most accurately in apposition. Primary union resulted with firm bony union at end of seven weeks.

CASE V—A. H. S., thirty-three years old, bridge carpenter, suffered a fracture of tibia and fibula as a result of a fall in January, 1913. After seven weeks there was no evidence of bony union. A removable case was applied and he was advised to walk upon the injured leg. After two weeks of this treatment there was still no evidence of union. Operation April 28, 1913, a five and one-half inch incision was made over the tibial crest and the ends of the broken shaft cut off by Gigli wire saw and rongeur forceps. A transplant about five inches long by

with disfavor upon partial removal. It is just as likely, more so I think, to happen if not stirred and whipped into an unwonted activity by incomplete operations; for often have I witnessed the latter, but never, I repeat, the former process.

A further, better and less speculative reason for non-interference is that the surgeon should not hold himself higher than the law which says "the greatest good to the greatest number." Great as our obligations to individual patients are, they are greater to all of our present and future clientele and to the cause of surgery. No one can or will deny that the best of laws, under the most beneficent government, exceptionally work individual hardships. Finally, such belated and ill-starred procedures first raise, then destroy false hopes in patient, family and friends and in addition thereto cause needless anxiety, suffering and expense. Palliative operations for the relief of pain, dyspnoea, pyloric, intestinal or other forms of obstruction are manifestly proper and should be done, even more frequently than they are, but only with the thought of relieving a definite symptom and not with the slightest hope of effecting a radical cure. Moreover, such a purpose should be fairly stated to the family of the patient, so that responsibility can be placed where it rightfully belongs. Were this always done there would soon come a better appreciation, professional and lay, of the inestimable benefits of early operation and, as surely, the infinite hazards of delay. And with it will come, what is desirable, a public sentiment which demands early operation in superficial lesions that are apparent and exploration in deep-seated ones which, from their nature are not apparent.

Let us turn from inoperable to operable cancer and see what can be accomplished if such patients are divided into early, fairly early, and late or unfavorable cases, the same classification made of patients with acute affections such as appendicitis, peritonitis, strangulated hernia, intestinal obstruction, diseases of the gall-bladder, etc.

The pessimist, and he is still about, will find as much to make him decry operative results in any of the above conditions

that the periosteum is not essential in the bone-forming process

It will be noted in these cases that no effort was made to secure union of the fibula. Perfect anatomical union of this bone is not essential, as the weight is all borne by the larger bone. In cutting the transplant a special dental engine or circular electric saw is of course most convenient. It is not, however, essential to accurate or rapid work. At the ordinary well-equipped hardware store one can secure a small triangular cabinet-maker's or wood-carver's chisel, which very materially aids in cutting the long transplant without danger of splitting or splintering. It materially helps, also, in loosening the graft after it has been outlined with the grooved chisel, if the splitting force of the larger chisel is applied from beneath the crest of the tibia upward. The bone then breaks in the grooved lines. Transplants six to ten inches long can be cut in this way with safety.

No drainage was used in any of my cases. The application of a tourniquet materially aided me in working rapidly. In none of my cases was the gloved hand, or any gauze, or any instrument that had come in contact with the skin, allowed to touch the wound, thus greatly lessening the danger of sepsis.

The ultimate result in these cases has been firm, bony union with but little callus formation. In the two earliest cases this has been so absorbed that almost no deformity whatever can now be detected.

one-half by two-fifths of an inch was removed from the crest of the opposite tibia. This was inserted into the reamed out end of upper fragment for about two and one-half inches. A groove was cut in the lower fragment to admit the transplant, which was pushed down into the reamed out cavity in the lower fragment. The wound was closed without drainage. Primary union resulted. Bony union was somewhat delayed, owing, probably, to the fact that the patient left the hospital and wore the same case for several weeks. Twelve weeks after operation, however, we had an opportunity of examining the leg. Patient was then walking about with a loose case still, which gave him no support. Upon its removal it was found that good bony union had taken place. Union in this case would have undoubtedly been more prompt had the patient not taken upon himself the responsibility of the after treatment.

My own experience would lead me to believe that non-union of the tibia and fibula is by no means uncommon. This seems particularly true when the fracture occurs at about the middle or upper third. I am inclined to think that a thrombus, developing in the nutrient artery of the tibia (which enters the bone at this point), is probably the explanation. In consequence of this impaired nutrition the process of bone repair is so delayed that connective tissue is interposed and forms a permanent block to the bridging across the gap by the Haversian system of osteoblasts. Murphy's contention seems most logical that the autogenous bone graft or transplant acts as an osteoconductive superstructure which carries the bone forming process across. If this is true a properly placed transplant, well in contact with either fragment, cannot fail, if it extends well beyond the infiltrated area, to bring about bony union in all cases of ununited fracture.

In my transplants I did not remove the periosteum. In two of the cases, however, in forcing the transplant into the reamed out ends of the tibial shaft the periosteum was completely stripped off from the lower half of the graft. Nevertheless union occurred just as promptly as when it remained perfectly intact. This would bear out Macewen's statement

I. THE GROSS PATHOLOGY OF PROSTATIC HYPERTROPHY.

Most of the recent articles dealing with prostatic hypertrophy have presented evidence and theories concerning the gross pathology of the prostate. The work of Tandler and Zuckerkandl (1) tended to show that all of our previous ideas of the gross pathology of prostatic hypertrophy were wrong. Lowsley (2) presented his study of a series of sections of the human prostate in its early developmental period, which were distinctly in contrast to the series presented by the Austrian scientists. Wilson and McGrath (3) presented their studies of over 400 specimens and agreed to a certain extent with the theories of Tandler and Zuckerkandl. Henry Wade (4) gives the results of his exhaustive study of prostatism and deals with the surgical anatomy and pathology of the operative treatment.

Our own observations have not satisfied us that these theories are absolutely demonstrated to the satisfaction of surgical pathologists. Lowsley agrees with the more advanced pathologists and recognizes five lobes in the prostatic mass. The middle lobe is quite independent of the others and its tubules are distinctly separated from the others. They are situated within the gland structure and are in relation with the floor of the urethra. The posterior lobe is situated furthest from the bladder and is almost an independent structure. It is further of interest to note that the tubules of the middle lobe lie side by side with those of the lateral lobes, but at no point do they intermingle. The lateral lobes are made up of a series of tubules on each side of the urethra and the acini of these lobes form the main mass of the gland. It is distinctly indicated that the lateral lobes are in direct relation with the urethra. The posterior lobe seems to be almost an independent structure and is seldom involved in hypertrophy of the gland. It, how-

liminary Treatment Indicated *Journal of the Michigan State Medical Society*, January, 1912

The Suprapubic Two-step Operation for the Removal of the Hypertrophied Prostate *American Journal of Surgery*, June, 1912

The Operative Relief of Obstructive Hypertrophy of the Prostate *Journal of the Michigan State Medical Society*, September, 1913

TRANSVESICAL PROSTATECTOMY IN TWO STAGES.

BY PAUL MONROE PILCHER, M.D.,

OF BROOKLYN, NEW YORK.

I THE PATHOLOGY OF CHRONIC PROSTATIC OBSTRUCTION II CONDITION INFLUENCING THE CHOICE OF TREATMENT-METHODS III THE THREE PHASES OF INTERRELATION BETWEEN OBSTRUCTION AT THE VESICAL OUTLET AND RENAL FUNCTION IV THE INDICATIONS FOR AND THE TECHNIC OF SUPRAPUBIC CYSTOSTOMY V TECHNIC OF TRANSVESICAL PROSTATECTOMY

INTRODUCTION

SINCE we have adopted the transvesical operation for the relief of urinary obstruction due to changes in the prostate, we have been able more fully to study the so-called living pathology of the condition inasmuch as the vesical outlet can be studied with the prostate *in situ*, the nature of the obstructing mass determined and the resultant deformities of the bladder studied. The removal of prostates in one piece in many cases and the interurethral enucleation in others has provided us with new material for extending our observations concerning the gross pathology of the disease.

Studying this last series of cases we are led to disagree with some of the more recently advanced theories concerning the pathology of the disease. In presenting this subject, therefore, we first offer our observations on the points in question. We do not reiterate much of the work which has already been published by Dr. Lewis S. Pilcher and myself.¹

¹ Pilcher, Lewis S. Choice of Operative Method for Removal of the Hypertrophied Prostate. *ANNALS OF SURGERY*, 1905, xli, 565.

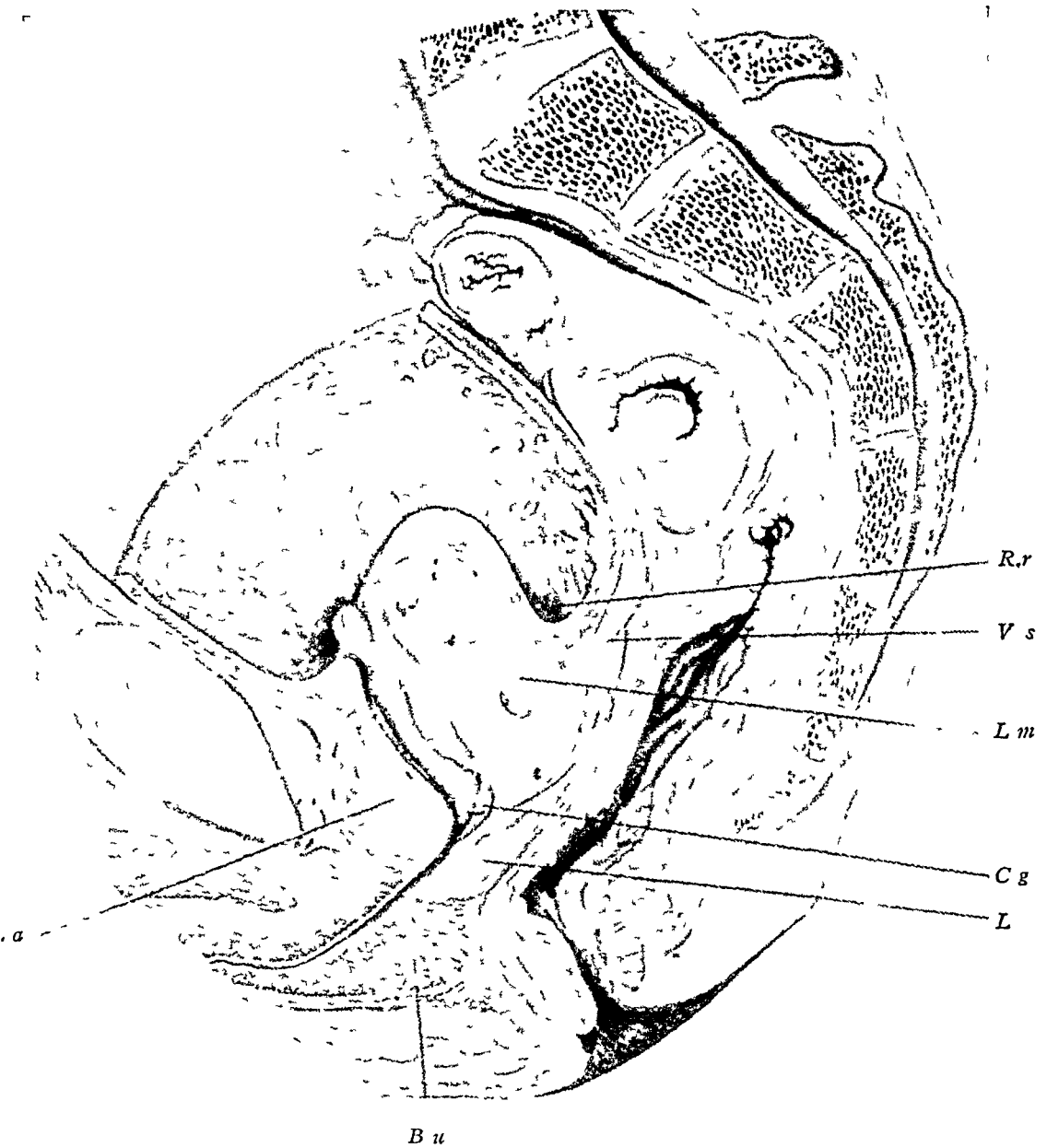
Observations Upon the Removal of the Prostate for the Cure of Prostatic Dysuria. *New York State Journal of Medicine*, June, 1906.

Urinary Obstruction from Prostatic Hypertrophy. *Year Book of the Pilcher Hospital*, 1911, 1, p. 60.

Pilcher, Paul M. Pathology and Etiology of Obstructive Hypertrophy and Atrophy of the Prostate Gland. *ANNALS OF SURGERY*, 1905, xli, 481.

Choice of Operation for the Relief of Prostatic Dysuria and the Pre-

FIG 1



Sagittal section through the pelvis showing the prostate hypertrophied *B u*, bulbus urethralis, *C g*, caput gallinaginis, *L a*, lobus anterior, *L m*, lobus medius, *R r*, recessus retrouretericus, *V s* vesicula seminalis. A short probe projects from the ejaculatory duct (Tandler and Zuckerkandl, verlag von Dr Werner Klinkhardt, Leipzig Wilson and McGrath)

ever, seems to be a starting point for malignant degeneration in many cases. The subvesical accessory glands of Albarran, which develop on the surface of the median lobe, are not of much clinical importance in the experience of the writer.

As a result of our personal observations hereinafter detailed we believe.

1 That Tandler and Zuckerkandl are mistaken in their conclusions that prostatic hypertrophy is always a hypertrophy of the anatomical middle lobe.

2 That Tandler and Zuckerkandl are incorrect in assuming that the so-called prostatectomy does not in a great majority of cases mean practically total removal of the prostate. We appreciate that in some cases of irregularly developed prostatic adenomata some prostatic tissue becomes atrophied and compressed and forms a shell around the adenomatous mass and is not entirely removed at operation.

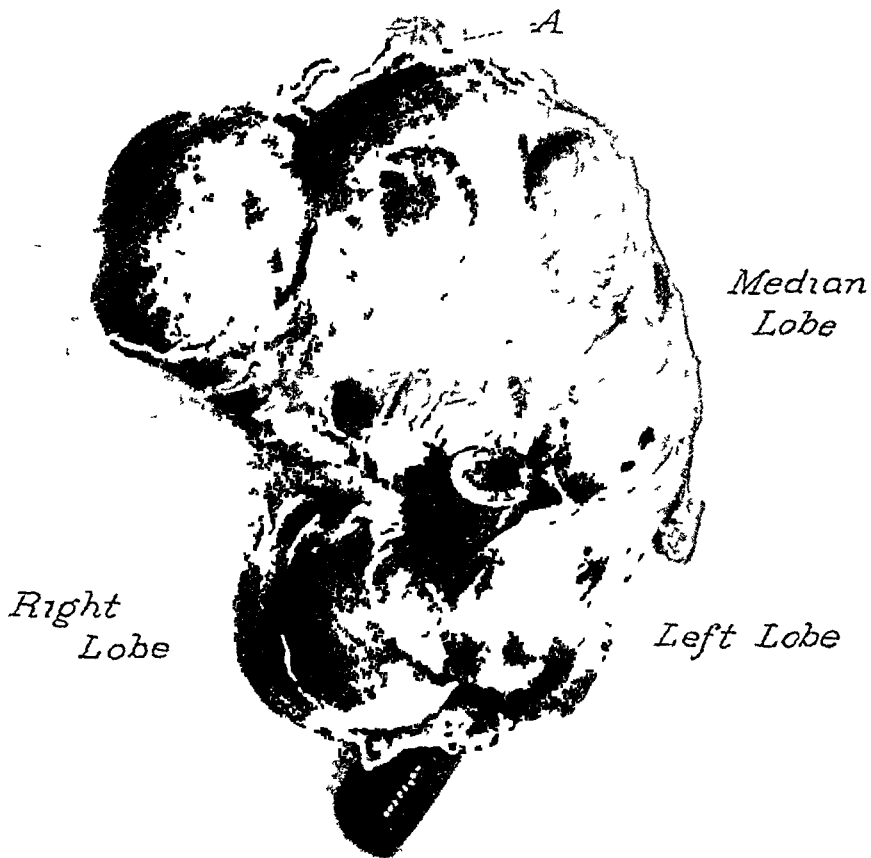
3 We question that the surgical capsule is formed only by compressed peripheral parts of the prostate.

4 We agree that the anatomical relations of the hypertrophied prostate to the sphincter vesicæ, the bladder itself and the ductus deferentes recommend the transvesical route as the one to be chosen in removing an enlarged prostate.

The first three of the conclusions advanced by the Austrians are so at variance with the accepted ideas of the pathology of the prostate in cases of obstructive hypertrophy, that the writer took occasion to visit Vienna and study the specimens which had been prepared by Professor Tandler and from which these conclusions were drawn. The writer spent some time in going over the question with Professor Tandler so that these observations are not based upon hearsay. Studying Tandler's specimens we accept his theory that the posterior lobe seldom hypertrophies. In other words, the enlargement takes place toward the bladder. However, in my mind the exhibits do not prove that the enlargement always involves the median lobe alone. If enlargement of the median lobe takes place, it must proceed along the avenue of least resistance, which is through the vesical outlet, gradually dilating it and forcing the sphincter

FIG 3

Anterior Surface



Paul Piloher

Enormous median lobe enlargement of the prostate with adenomatous changes in the lateral lobes. These lobes are smaller than normal and show no atrophy due to pressure. The specimen presents a view of the anterior face. The part above the rubber tube was entirely intravesical. The anterior face is covered by mucous membrane.

FIG 2



Prostatic mass removed by transvesical operation rubber tube showing direction of urethra Beneath the rubber tube is a greatly hypertrophied middle lobe The lateral lobes are seen forming the sides and roof of the urethra but are not in any way obstructive

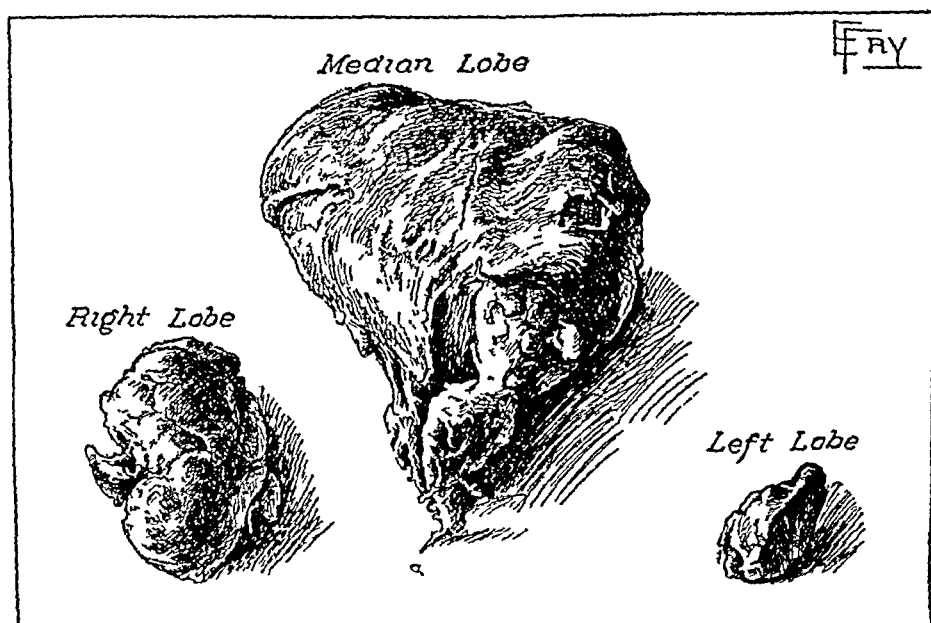
as in cancer, if he will only consult the various hospital reports the country over and then make a sum total of the enormous number of unnecessary deaths resulting from conditions which were once simple, local, and therefore, nearly always curable by early operation. It is needless for any member of this Academy to take that trouble, as it is only necessary for him to recall how often he and his assistants are telephoned to, and then usually at night, or worse, the wee, 'sma' hours of morn, to see, for the first time, some valuable member of society either actually dying, or in a condition to preclude operation at the hands of any surgeon of judgment. There will be others, again, so extremely ill that one thinks carefully, balancing every argument for and against operation before coming to a decision, others still more favorable from an operative standpoint, and yet toxic enough, through delay, to make the operator think many times as he prepares for operation, how much better it would have been if some one had not already blundered. Surgeons are largely responsible for such a condition in all of our hospitals, for just so long as they are willing and continue to operate upon such patients, just so long will they be furnished

That such patients with acute disease sometimes unexpectedly recover after operation is, of course, quite true, and justifies the taking of many chances. But such is not true of advanced carcinoma, where a reasonable knowledge of pathology makes it next to certain that nothing can or should be done in the way of surgery. We are not depriving the patient of any chance at all, or one so slight as to be negligible, whereas we are giving others their chance of an early and beneficent operation by compelling them to see and understand the value of timely action. Is there a man here who has not seen one or many women conceal from their relatives and friends tumors of the breast, on account of their dread of an operation, giving nearly always the same reason—that some friend had been unsuccessfully operated upon?

But to be more specific and less general, let us consider briefly a few facts made plain by the last report of the Cancer

remained imbedded in the capsule of the prostate after the adenoma had been enucleated Fig 7 is an example of symmetrical enlargement of the median and both lateral lobes Fig 8 is an example of bilateral hypertrophy without any median lobe enlargement The specimen is very distinct and convincing on this point Fig 9 is another example of irregular hypertrophy of the lateral lobe with very little median lobe enlargement Fig 10 shows a specimen removed in one piece in which the median lobe is enlarged and has pushed forward into the bladder and distorts the urethra, lifting it up and mak-

FIG 4



Drawing showing the three lobes of the prostate separated Same specimen as Fig 3

ing it almost impossible to empty the bladder The position of the sphincter is indicated by the arrows Fig 11 shows still another type of development The lateral lobes in this case had been previously removed by perineal operation The symptoms persisted and three years later this median lobe enlargement, with a very freely movable ball valve attachment, was taken out by a transvesical operation No remnants of the lateral lobes could be found It is interesting to note the position of the internal sphincter as indicated by the arrows

ring wide open That this frequently occurs is well shown by many specimens However, it is hard to accept the theory that in some cases, or in many cases, the enlargement of the median lobe takes place in the direction of the lateral lobes, displacing them and causing atrophy of these lobes, compressing them out into a shell-like capsule; to produce a lateral extension of an adenoma of the median lobe, the expansion must take place, not along the avenue of least resistance, but against a firm, well-developed structure Judging from the anatomical relations as found on the operating table, Tandler's conclusions as to the part of the prostate involved in the obstruction are incorrect

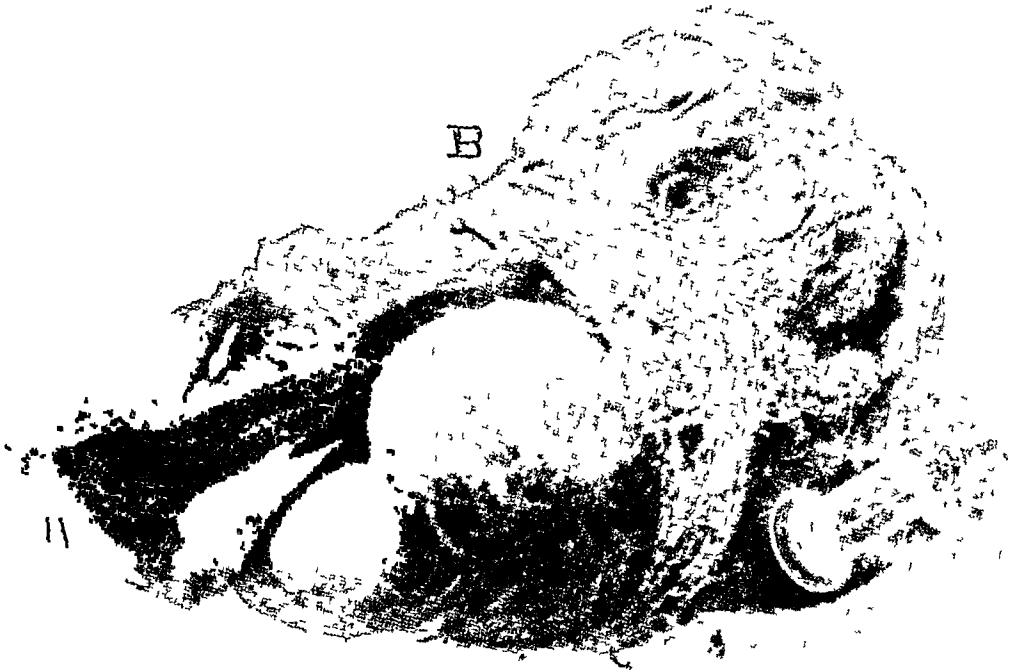
Fig 1 is an illustration taken from the work of Tandler and Zuckerkandl, showing a sagittal section through the pelvis in a case of prostatic hypertrophy We agree that this represents a typical case of median lobe enlargement A number of other illustrations which are shown in the work of Tandler and Zuckerkandl are unquestionably examples of median lobe enlargement, for in each the adenomatous mass is more or less symmetrical in the median line and is forced through the sphincter dilating it The same phenomenon has been plainly shown in many of our own specimens, for example, Figs 2, 3, and 4 At the same time, the enlargement of the lateral lobes without the median lobe enlargement may take place, and in such cases the sphincter is greatly dilated and surrounds the hypertrophied mass Such a case is seen in Fig 5 In this case the lateral lobes have become enormously hypertrophied and have carried the median lobe, which is also enlarged, through the sphincter well into the bladder It cannot be conceived that, after the enucleation which was accomplished in this case, any prostatic tissue was left behind unless it was the posterior lobe which is so nearly independent Fig 6, however, shows a different condition This was a case of complete urinary obstruction, which had lasted for three years *B'*, *B'* are the adenomatous lateral lobes *B* is a greatly hypertrophied median lobe *A* is a crescent-shaped calculus, and the remaining pieces of tissue are compressed and atrophied bits of prostatic tissue which still

FIG 6



Photograph of prostatic masses removed by transvesical route. *A* is a crescent-shaped calculus. *B* a large median lobe. *B'* *B'* the two lateral lobes. The other pieces of tissue shown are atrophied prostatic tissue adherent to the capsule.

FIG 5



Photograph of hypertrophied prostate removed by suprapubic route. Showing bilateral and median enlargement. At vesical pole 4 the capsule and mucous membrane of the bladder are shown stripped back from the glandular portion of the gland. At B is seen the circular capsule which passes entirely around the gland.

FIG 9



Specimen removed by transvesical operation showing irregular hypertrophy of the lateral lobes with very little median lobe enlargement

FIG 10



Specimen removed by transvesical operation showing marked median lobe enlargement with practically no lateral lobe enlargement

FIG 7



Specimen removed by transvesical operation showing symmetrical enlargement of both
median and lateral lobes

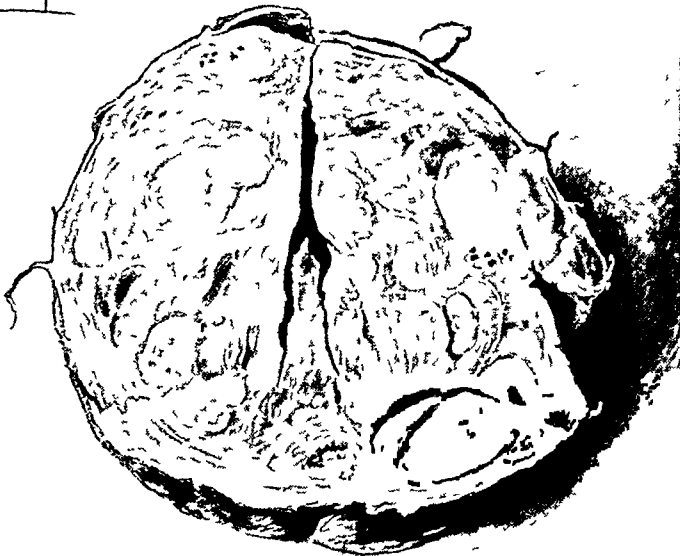
FIG 8



Specimen removed by transvesical operation showing hypertrophy of lateral lobes without
involvement of median lobe

FIG 13

FRY



Cross section of specimen shown in Fig 12 showing relation of median lobe and two lateral lobes to the urethra

FIG 11



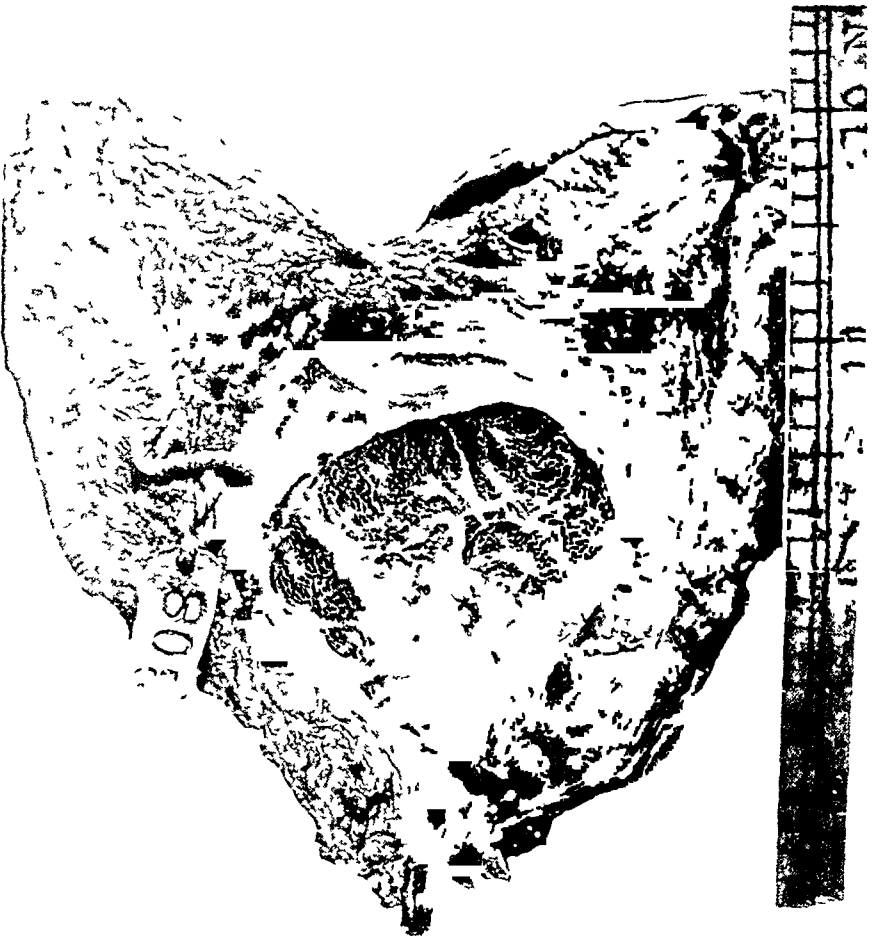
Median lobe enlargement with ball valve attachment

FIG 12



Enlargement of the prostate in which the two lateral lobes are involved. The vesical surface of the prostate appears at the top of the picture. This specimen was removed within its capsule and is a perfect example of coincident hypertrophy of both lateral lobes without any marked median lobe enlargement. The section through this mass is seen in the following figure which shows the narrow cleft occupied by the urethra. The two lateral masses and the small adenomatous median lobe are seen.

FIG 17



Photograph of a perfect example of a median lobe enlargement without hypertrophy of the lateral lobes (Reproduced from Francis S. Watson's work on The Operative Treatment of the Hypertrophied Prostate)

FIG 14



Bilateral and median lobe hypertrophy of prostate. Position of colliculus. This photograph shows the exact relation of the urethra, hypertrophied prostate and bladder as an example of moderate bilateral hypertrophy of the prostate with median lobe enlarged and projecting into the bladder, the median lobe forming the chief obstruction. Following the urethra upward from the bladder it will be seen that the urethra inclines sharply downward due to the bulging of the median lobe, which forms the floor of the urethra as far forward as the colliculus. If the finger were introduced into the urethra through the bladder, it can be easily seen from this picture how the entire prostate could be removed without injury to the colliculus. (Reproduced from Francis S. Watson's work on The Operative Treatment of the Hypertrophied Prostate.)

In this case we had the obstruction of the enlarged mass and in addition a ball valve action

Fig 12 is the photograph of a specimen, actual size, removed in one piece. It is a perfect example of hypertrophy of both lateral lobes of the prostate Fig 13 shows a section through the centre of this mass and shows quite distinctly the three lobes, the two lateral lobes and the median lobe, and their position in relation to the urethra. The median lobe extends up like a wedge between the two lateral lobes and is only moderately enlarged In this connection reference may be made to the series of photographs of specimens which were published in 1888 by Francis S Watson, of Boston, in his treatise on the Operative Treatment of Hypertrophy of the Prostate Plate 4 (reproduced here as Fig 14) shows a very important feature, the lateral lobes are moderately enlarged, the median lobe is distinctly enlarged and is projecting into the bladder, forming the cause of the obstruction Distal to the median lobe enlargement is seen a raised-up portion, which is the colliculus or verumontanum, at which point the vasa deferentia empty into the urethra If the finger is introduced into the urethra by the transvesical route in enucleating the prostate, one can easily see from the specimen how the colliculus may be preserved. Fig 15 is an undeniable example of hypertrophy of both the lateral and median lobes of the prostate This specimen, which is a dissection not only of the prostate but of the bladder as well, shows exactly the relation which no drawing could so well express Fig 16 shows another phase which is a bilateral hypertrophy of the prostate with a slight median lobe development causing a distinct prostatic bar The tortuous course of the urethra, the presence of the colliculus and its relative position are clearly shown No one could argue that in these specimens such a hypertrophy originates from the median lobe alone The floor of the urethra is very clearly shown and is seen to be free from all hypertrophied tissue This portion of the urethra must invariably be involved, at least that portion between the colliculus and the sphincter, in all median lobe enlargements Fig 17 is a perfect example of median lobe enlargement alone

Commission of Pennsylvania, prepared with great care by its Chairman, J M Wainwright

There were four hundred cases reported by surgeons throughout the State and, while the number is not great, it is enough to give a fairly accurate knowledge of conditions which obtain in Pennsylvania. Bad as they are, the statistics probably indicate a more favorable condition than actually exists, as a record is usually not made of the most advanced cases which do not come to operation at all.

Only 68 per cent of the superficial carcinomata and 48 per cent of the deep-seated ones are operable when first seen by a surgeon. The superficial lesions had been apparent to their hosts eighteen months before a surgeon was consulted, and in deep growths well-marked symptoms of the disease had been present fourteen months. In superficial growths thirteen months had elapsed, on an average, between the time the family physician was first consulted and the date of operation; and in deep-seated ones, a year.

In 3 per cent of the cases of cancer of the breast the physician first consulted failed to make a local examination, and in 13 per cent advised local applications or "waiting to see what develops."

In gastric cancer the first physician consulted made no local examination in 9 per cent and gave bad advice in 20 per cent.

In cancer of the cervix no local examination was made in 10 per cent and bad advice given in 20 per cent.

In cancer of the ovary no local examination was made in 14 per cent and non-intervention advised in all of them.

In conclusion Wainwright says. "This work was undertaken to show, if possible, just where the greatest responsibility lies. It is, of course, to be proportioned to the medical profession on the one hand and the general public on the other. There is the greatest possible room for improvement in both, but of the two it would seem that the medical profession should show a marked improvement first. We cannot view with complacency the fact that, as a general average, cancer patients

Same specimen as Fig 18. The anterior commissure divided showing two lateral hypertrophied lobes and the normal sized median lobe joining the two enlarged lobes



Fig 19

Specimen removed by transvesical operation, showing under surface in a case of enlargement of both lateral lobes



Fig 18

In this case the lateral lobes are distinct, but not hypertrophied. The specimen shown in Fig 18 shows well the part taken by the lateral lobes in some cases of obstructive prostatic overgrowth. The specimen was removed by the transvesical route, and the entire deformed portion of the prostate was removed in one piece. Fig 18 shows the under surface of this prostatic mass. A rubber tube passing through the specimen indicates the position of the urethra. At the top of the specimen is seen a small collar which is the mucous membrane stripped up from the internal sphincter. This sphincter could be appreciated by a finger in the bladder. Fig 19 is another photograph of this same specimen viewed from the anterior surface, showing, roughly, the course of the urethra, as exaggerated by the furrows produced by the presence of the rubber tube in the hardened specimen. The two lateral lobes which appear like the wings of a butterfly are joined together across the median line by a practically normal median lobe which is in no way hypertrophied. The collar of mucous membrane also appears at the top of this specimen and shows the lack of any bulging in the bladder. As far as could be appreciated by the finger, the entire prostate was removed in this case with the possible exception of the posterior lobe of the gland which was distal to the ducts, but the remains of which could not be appreciated by the finger. Examination of the cavity from which this prostate was removed, made immediately after the operation, demonstrated no tissue remaining which in any way resembled prostatic tissue. Fig 20 is a photograph of a specimen removed the same day as the previous specimen and shows the prostatic mass as removed in one piece. The small drainage tube occupies the position of the urethra and shows it distorted and the presence of the greatly enlarged median lobe which extends into the bladder and lifts the urethra up. The bladder in this case is to the right of the specimen. As one views the specimen grossly, it would look as if the entire adenoma were one piece. When, however, the anterior commissure is divided, the specimen falls apart and forms three distinct portions, the two lateral masses, which are the lateral lobes, are greatly hyper-

FIG 22



Same specimen Shows this same condition more clearly

FIG 23



A close view, through cystoscope of a dilated ureter opening with lax walls

FIG 20



Specimen removed by transvesical operation showing the entire prostate removed in one piece

FIG 21



Same specimen as Fig 20 The anterior commissure divided allowing the hypertrophied right lobe to drop down showing the relation of the enlarged middle lobe and the left lateral lobe to the urethra The middle lobe is seen to form the floor of the urethra for a distance of about one and one half inches but does not extend as far up on the urethra as the lateral lobe

trophied and compress the urethra, the course of which is indicated by the furrow (Fig 21) To the left in the upper quadrant of the picture is seen the median lobe which extends well down into the urethra, well past the first portion of the lateral lobes, in fact, forming a wedge-shaped lobe between the portions of the lateral lobes which extend into the bladder. However, the specimen clearly shows the relations of the two lateral lobes to the urethra Fig 22 shows another view of this same gland which indicates more clearly the exact position of the urethra and its relations to the lateral lobes and to the median lobe. In this specimen one lateral lobe has been removed and the furrow, as indicated in the specimen, shows the relation of the urethra to both the lateral and median lobes The lateral lobe forms the side wall for over two inches, while the median lobe, passing beneath the urethra, extends along it for an inch and a quarter

Our own deductions are based primarily on an analytical study of our own cases, taking into account, first, the conformation of the prostatic mass as presented to the cystoscopist and judged by the eye, and the mass as found *in situ* at the time of operation and appreciated by the finger; second, a careful determination of the adenomatous mass in relation to the opening of the urethra and the sphincter vesicæ, and third, a thorough gross and sectional examination of all our specimens after removal by the transvesical route

Professor Tandler has not demonstrated conclusively that the lateral lobes of the prostate are compressed and atrophied by enlargement of the anatomical median lobe If he could show us the various stages of the development of this phenomenon by microscopical section, we would be convinced of his argument, but he has not presented any microscopical sections showing the transition from the adenoma involving the median lobe and atrophy of the lateral lobes Furthermore, before we could accept his theory of the enlargement being confined only to the median lobe, it would be necessary to show that the ducts leading from this lobe were entirely distinct from the ducts leading from the lateral lobes

years, during which the new method hereinafter to be described has been followed, we have secured 100 per cent. recovery. In the malignant growths covering the same period, consisting of six cases, there has been one death. In this case besides removing the prostate, the base of the bladder and the seminal vesicles were also resected.

RESULTS—*In the non-malignant cases* above mentioned the average length of life is limited by old age and the various ills incident to its progress. All of the cases have had full control of their urine and they have returned to their normal health again. *Of the malignant cases*, one patient is living two years and two months since his operation and is now showing marked cachexia, but is still able to void his urine without the use of the catheter. A second patient is living, one year and two months since his operation, with marked symptoms of carcinoma involving the rectum, but is still able to empty his bladder. A third case died 12 hours after the operation. A fourth is still living, four months after operation, with no symptoms as yet referable to the bladder, complete control and voids normally. The fifth case was operated upon two months ago; still no symptoms of return and voids normally. The sixth case is still in hospital making a good recovery. *One case of tuberculosis* of the prostate was operated upon in which the prostate was removed by this method. The patient recovered and is to-day perfectly well, one year and four months since the operation.

2 OPERATIVE CONSIDERATIONS—*The chief indication*. If practitioners and surgeons will hold in mind the fact that *the chief indication is primarily to relieve the retention of urine rather than the removal of the prostate*, the entire subject of obstructive prostatic disease will assume a different aspect. If we could dissuade surgeons, as a rule, from the course of immediately taking out a prostate which is known to be obstructive, we would do much to help the cause of the prostatitics.

There are two methods of accomplishing the relief of the retention of urine, and one of these two methods should comprise the first step in every operative encroachment upon the

II THE CHOICE OF TREATMENT

Assuming the diagnosis to be correct, that is, that obstructive prostatic disease exists, how shall we determine the course of treatment? And when the indication for prostatectomy is present, what is the safest procedure?

I PALLIATIVE MEASURES —The establishment of a catheter life, destroying an obstructing mass by using the cautery or punch, or the high frequency spark, are all but temporary expedients. Any and all of these methods may be used to insure the patient's temporary relief, but invariably the patient continues to become more enfeebled, is constantly the slave of his bladder, his mind is never at rest and finally, as a rule, he must face either an operation or death. Certainly this fact has been most forcibly demonstrated in the recent survey of our non-operated cases. These cases naturally fall into three classes, those in which the urinary obstruction is due to benign hypertrophy of the prostate, in other words, a chronic interstitial prostatitis, second, those cases in which the obstruction is due to carcinoma of the prostate, and third, tubercular hypertrophy of the prostate.

In the first class, in those cases in whom the obstruction has developed to that stage where the use of a catheter, either at intervals or every day, has become necessary to insure their comfort, infection sooner or later takes place, followed by sepsis, uræmia, etc., and the average length of life is less than three years. This is a little longer than the average time found in Squier's recently tabulated cases. All of this time, however, the patient lives in filth and misery and is a burden to himself and a trial to his friends.

In the second class of cases, the unoperated malignant growths of the prostate, no average can be stated which is of much value. The progress of cancer in the prostate is slow as a rule, but where there is much obstruction due to the growth, the combination of uræmia and the effects of the cancer often terminate the life of the patient within a year.

In the last 28 cases of benign hypertrophy of the prostate, which comprises all cases operated upon within the last two

have been under the care of their family physicians more than a year before they applied for a radical cure "

This report shows clearly enough that only a comparatively few patients afflicted with cancer get the benefit of an operation while the disease is local, simply for the reason that metastases will, in the vast majority of instances, have occurred before a surgeon is consulted. If only a single one of the nearest lymph nodes be involved the disease is no longer local, but becoming general, and the chance of cure less than one-third what it would have been had operation taken place before such involvement. For instance, in the cases of mammary cancer operated in the Johns Hopkins Hospital since 1889, 80 per cent of those without glandular involvement, and only 25 per cent of those with axillary infection, were cured.

I am not aware that any one has attempted to indicate just when the lymphatic glands first show involvement in the several regions of the body where carcinomata frequently arise. It is safe to assume that it very generally does occur within a twelve-month on an average. In cancer of the tongue, mouth, breast, and cervix uteri it will take place sooner I feel certain, and in the skin, lip, large intestines, and rectum, probably later. The little knowledge we now have is conjectural and based upon the time when there is palpable enlargement. This avails next to nothing, as it will vary with the accuracy of the local examination, the region, and the amount of fat and other tissues superlying such enlargement.

In the mammary gland cancer will cause palpable enlargement of the axillary nodes in rather more than a year, according to Gross (156 months), Winwarter (147), Oldekop (165).

Finney states that such enlargement occurred in the patients treated at the Johns Hopkins Hospital in from ten to thirteen months, and that 84 per cent of such patients showed axillary involvement when first consulting the surgeon. Of W. T. Bull's series 65 per cent showed palpable enlargement when he first saw them. Finney's opinion is undoubtedly nearer the truth, based as it is upon a larger number of cases and formed at a much later date, when the significance of such involvement is

bladder for this disease. First is the use of an indwelling catheter which systematically drains the bladder for a definite period of time until the kidney has reacted from the changed condition. This method may also be used to clear up the cystitis. The second method is a suprapubic cystostomy and the introduction of a permanent catheter occupying the cystostomy wound for the same purpose as an indwelling catheter.

Before discussing the relative values of these two methods, one of which should always be employed before prostatectomy is considered, I wish to present a few facts which demonstrate that retention of urine in the bladder in prostatic disease has a very distinct and fundamental effect upon the general economy.

The Kidney as Affected by Prostatic Hypertrophy—First, clinical evidence. The clinician will observe, in cases of prostatic disease in which there is considerable retention of urine, that the most marked symptoms will be evidences of intestinal stasis, loss of appetite, loss of sleep, changes in temperament, mental degeneration, lack of personal pride, loss of weight and a general deterioration of the entire organism. Aside from this, further examination will show various phases of uræmic poisoning, in many cases a very marked increase in the secretion of urine with low specific gravity. Frequently the amount of urine will reach 150 ounces in 24 hours and its specific gravity be as low as 1002. In a recent case the 24-hour record was over 300 ounces. This, of course, is an index of functional derangement of the kidney. The rapid disappearance of all these clinical evidences of disturbed renal function, which follows draining of the bladder, shows the direct relation of cause and effect.

We have both acute and chronic, partial and complete forms of obstruction.

In the cases of *chronic partial obstruction* it has been noted in general that the amount of urine secreted is increased, providing the bladder is strong enough to regularly overcome the partial obstruction, and partially empty the bladder so that at no time the back pressure from the bladder is continually great. Where the musculature of the bladder is not so strong,

chronic obstruction extending over that portion of the ureter which passes through the bladder wall. It is the exceptional case in which the infection is an ascending one, but usually, in my opinion, it is due to hematogenous and lymphatic infection of a tissue whose resistance has been greatly lowered by mechanical obstruction

Second, objective symptoms The cystoscope shows that many changes have taken place in the bladder. First, we note that the muscular walls are markedly changed. They are hypertrophied and trabeculated, and false and true diverticula are formed, and occasionally calculi of various sizes and shapes are seen. Occasionally, also, the infection of the renal pelvis which follows retention of urine predisposes to the formation of renal stones which may be shown on the X-ray plate.

The cystoscope, as a rule, shows the *ureter opening* raised up on a ridge with the interureteric fold quite distinct. The ureter opening in the majority of cases is normal with the exception that it is changed by the general muscular hypertrophy which surrounds it. Occasionally the ureter opening is dilated, as is seen in the accompanying illustration (Fig 23).

Thrd, the operative proof From a careful study of a series of cases in which a preliminary cystostomy was done, certain phenomena were repeatedly observed which seemed to justify us in dividing the sequelæ to advanced prostatism into three phases. It has further emphasized in our minds the peculiar balance existing between the heart, kidney, secretion of urine, and the nervous control of these in the patient who has gradually become used to over-distention of the bladder. The pathology of this condition has already been referred to.

We have learned not to rely upon any one clinical sign or symptom in judging the fitness of the patient for operation. We have learned that the balance between the various elements of the system are so adjusted that a disturbance of one element will bring to light weakness in some of the other elements which has not been suspected, for example, *the phthalein test*. This may be very deceptive. The patient may show 60 to 70 per cent of excretion of phthalein in two hours before anything

and there is a chronic retention of a considerable amount of urine with very little overflow, the amount of urine secreted will often average as high as 120 to 150 ounces in twenty-four hours with a low specific gravity.

Where we have a contracted bladder with greatly thickened walls, in which there is only a small amount of retention, and the amount of retained urine almost entirely fills the contracted bladder, the urine is passed very frequently and in small amounts. Such a bladder may contain only two or three ounces and is almost continuously full. Under such conditions the kidney seems to diminish its secretions. The total amount secreted in twenty-four hours may be very little, finally resulting in complete anuria.

The other cases are those of acute retention of urine, in which the kidneys act freely until the bladder is filled to its capacity, at which time the kidneys stop acting entirely. It must be remembered that the bladder will never rupture from overdistention due to accumulation of urine.

Aside from the clinical evidence of renal infection and renal insufficiency already presented, the most striking evidence of renal injury due to prostatic obstruction is presented in those cases dying from the disease. Autopsy shows a variety of conditions existing in the kidney, the lesion most common to all being a hydro-ureter beginning immediately above the bladder, resulting in various degrees of hydronephrosis and destruction of the kidney parenchyma. This in turn is influenced by the degree and duration of the obstruction and in more advanced cases is accompanied by infection, the formation of renal calculi, and, in some cases, by actual infection and destruction of the kidney parenchyma.²

To the mind of the writer those lesions are brought about by two mechanical conditions. 1. The hypertrophy of the muscular walls of the bladder through which the lower end of the ureter passes and, 2, the constant presence of residual urine which helps to keep the muscles compressed and forming a

² Wade Prostatism, Fig 40 March ANNALS OF SURGERY, p 334

FIG 24

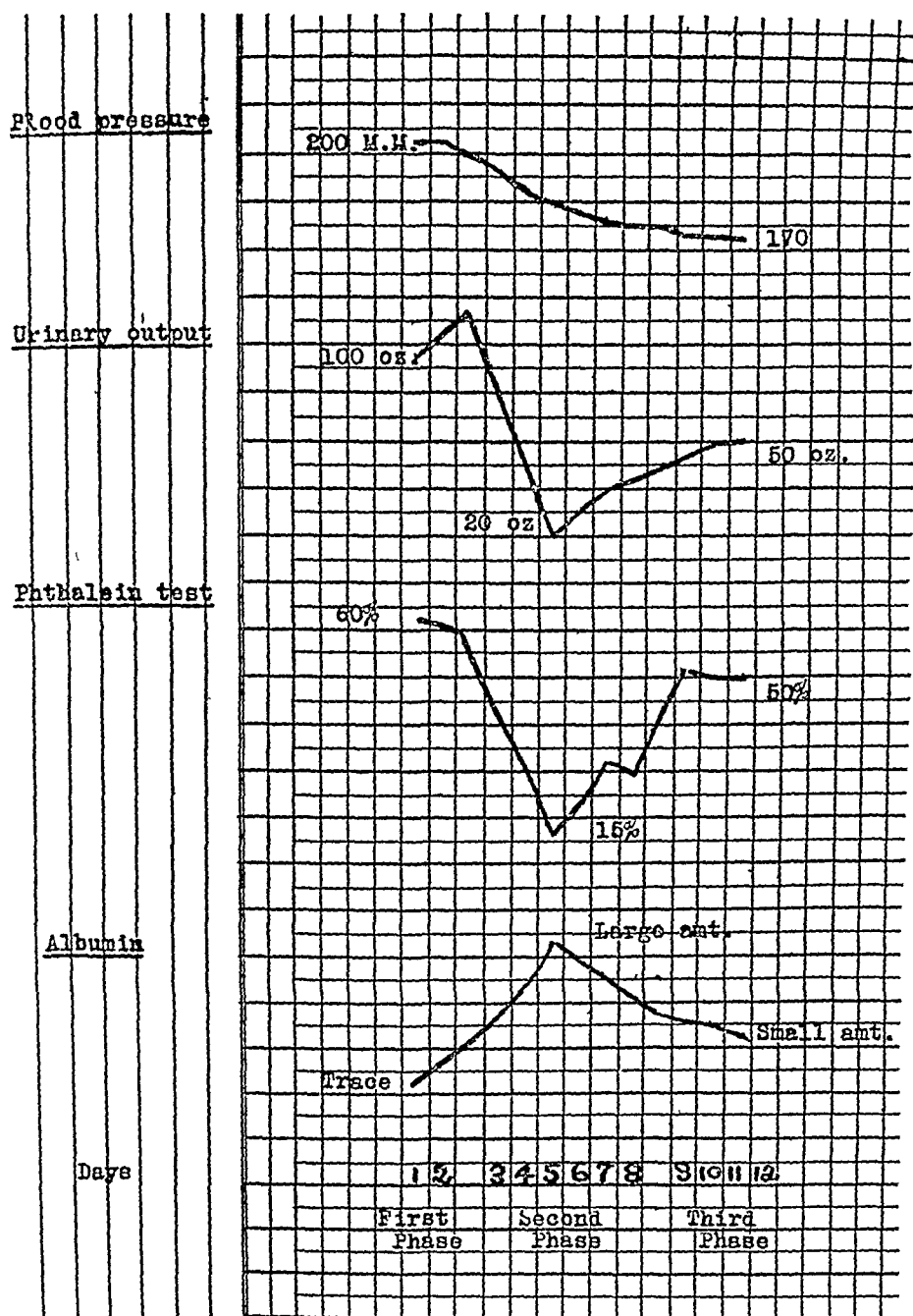


Chart showing the three phases following suprapubic cystostomy in an advanced case of obstruction due to prostatic hypertrophy

First phase Includes the first and second day, the suprapubic cystostomy being done on the first day. If one would observe this chart excluding the following days the conditions would seem to be favorable for any operative encroachment. See page 514. If taken alone this surely would seem to indicate a safe surgical risk.

Second phase This phase extends over the third fourth, fifth and sixth days after a suprapubic cystostomy. It shows a very marked decrease in urinary output during that time,

(Legend continued on next page)

has been done to relieve the retention of urine. But disturb the retained urine in the bladder and all of the other elements of the system are thrown into confusion. The back pressure is relieved, decompression of the kidney follows, swelling and congestion of the kidney takes place, and the functional capacity of the kidney immediately drops to a very low point. The outward signs of the derangement of this unbalanced kidney are very evident. This is the second phase. It is our belief that many of the cases which have died following operation are the result of a lack of appreciation of this second phase of a renal disturbance in prostatics. Many deaths have been reported on the third to the fifth day following a one-step prostatectomy, when the patient was seemingly doing well, but when we add the phenomena of the second phase to the shock of the major operation with its loss of blood and the depressing effect of the general anæsthetic, it can be easily appreciated why these deaths take place, and many will agree that the overtaxed heart and the system overloaded with toxins which the kidneys should separate from the blood are the cause of death. Our extended observations have shown us that nearly every prostatic will present these three phases, and this fact has influenced us very greatly in favor of the two-stage operation in every case of benign hypertrophy.

III THE THREE PHASES

The results of our observations are graphically shown on the accompanying chart, Fig 24, which shows the average condition which prevails in many advanced cases of obstructive hypertrophy of the prostate.

The First Phase—For the first day, the day on which the suprapubic cystostomy is done, the blood-pressure frequently registers from 200 to 220 mm of mercury, the urinary output for 24 hours will average from 70 to 120 ounces, the phenol-sulphone-phthalein test will frequently average above 60 per cent in two hours and the urine will show only a trace of albumin. If these conditions are considered by themselves, they will give us a false impression of the actual condition of the

the condition following drainage of the bladder, we find in the average case that on the seventh to tenth day the blood-pressure has decreased to from 160 to 170 mm, the urinary output has increased to from 40 to 50 ounces in 24 hours, the phenolphthalein test shows a reaction of the kidney from an output of 15 per cent to an output of 50 per cent, and the amount of albumin contained in the urine has decreased very markedly, but still shows a small amount present, more than was present before the cystostomy and very much less in amount than was found on the third or fourth day

Now if the prostatectomy is performed, the effect upon all these phenomena is quite different than was found after the preliminary cystostomy. The blood-pressure falls still lower, the urinary output decreases very little, the functional capacity of the kidney does not fall more than ten points, it is difficult to ascertain the amount of albumin present in the urine on account of the presence of the wound in the bladder, but at no time is it as great as was found on the third or fourth day after the cystostomy was performed.

By following this method we entirely avoid the second phase after the prostatectomy.

This conclusion is based upon the study of our last 28 successive cases, all of which have been operated upon after this method and all of which have recovered. It must be remembered that the second phase will last from a day or two to many weeks, and *if the reaction to the third phase does not take place within ten days to two weeks, the surgeon should not under any circumstances be persuaded to remove the prostate*, because if he does the chances are very much in favor of a fatal outcome. In one of our cases a gastric uræmia developed on the third or fourth day and *it was impossible to remove the prostate for over five weeks*. At the end of that time the third phase of the phenomenon appeared and the prostate was removed without any shock to the patient, followed by uncomplicated recovery.

All clinical observers naturally realize that the different stages vary in many cases as to their extent and their duration.

patient For example, if the patient's blood-pressure registered 200, was passing 90 ounces of urine in 24 hours with low specific gravity and with only a trace of albumin, we would be rather suspicious of the functional capacity of the kidneys. But when we make a phenol-sulphone-phthalein test, and find that the output in two hours is 60 per cent. or more, it rather leads us to believe that the actual functional capacity of the kidney is greater than the specific gravity of the given specimen would lead us to believe

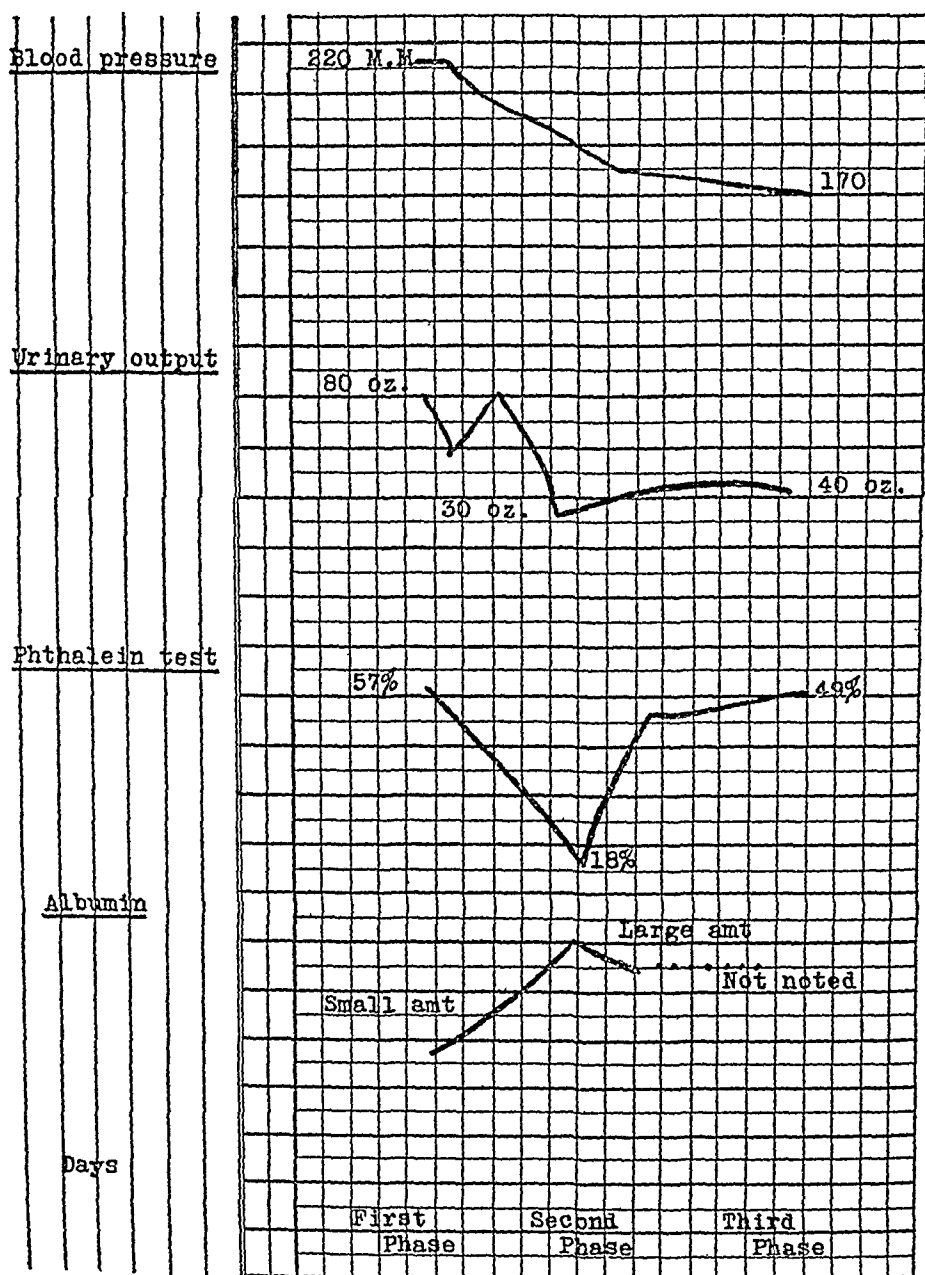
The Second Phase —A second glance at the chart will show a very different condition existing on the third or fourth day after the bladder has been opened and drained. Here we see a lowered blood-pressure, probably between 170 and 180 The urinary output has suddenly dropped to from 15 to 20 ounces in 24 hours; the amount of albumin in the urine has increased enormously and often the urine itself boils almost solid On the third to fourth day, the phenolphthalein test shows the actual functional capacity of the kidney at this most critical time to be only 15 per cent This, then, is the change which has taken place simply following a suprapubic drainage of the bladder without any loss of blood or other surgical shock due to anæsthesia or prolonged manipulation Add to this, then, the shock of a prostatectomy with its general anæsthesia, a very considerable loss of blood and the shock consequent to pain, and one does not wonder that so many cases have died on the third, fourth and fifth day from no apparent cause which could be demonstrated

The Third Phase —Passing on then to the third phase of

a large increase in the amount of albumin present, but most important of all the drop in functional capacity of the kidney from 60 to 15 per cent

Third phase Showing the reaction and the recovery of the kidney after ten days Blood-pressure 170, urinary output averaging 50 phthalein test 50 per cent, and a smaller amount of albumin present in the urine Comparing this phase with the first phase we find a lower blood-pressure, a normal urinary secretion with an increased specific gravity, a lowered functional capacity of the kidney, as attested by the phenolphthalein test and a larger amount of albumin present in the urine than during the first phase When, however, the reaction from this phase following enucleation of the prostate is considered, what a much better combination of circumstances exist in this phase than in the first phase Following prostatectomy, the blood-pressure falls still lower, due to the loss of blood The urinary output decreases most markedly during the first 24 hours but recovers rapidly until on the third day it is practically normal The phthalein test shows lessened reaction, but it never drops as low as was found in the second phase after suprapubic cystostomy, so that 50 per cent according to the phthalein test in the third phase shows a very much greater relative functional capacity than 60 per cent in the first phase This we consider a point of very great importance The amount of albumin following the operation is an unknown quantity

FIG 25



THE THREE PHASE CYCLE

Chart of Case I Showing the three phases in a patient 82 years of age. Note the marked difference between the three phases—especially the drop from 57 per cent to 18 per cent in the renal efficiency and the large increase in amount of albumin. Prostate enucleated during third phase. Recovery.

age of 82 years and his mitral insufficiency and chronic interstitial nephritis. It was, therefore, deemed proper to attempt enucleation of his prostate.

This point may best be emphasized by the following illustrative cases

CASE I—*Diagnosis Hypertrophied prostate, complete obstruction, vesical calculus, mitral insufficiency, chronic interstitial nephritis, double inguinal hernia*

Condition on entrance to hospital July 14, 1913. A large framed man, *eighty-two years of age*, who has led an active seafaring life. For ten years has had increasing frequency of urination and for two years has used catheter daily for the removal of residual urine, *now depends entirely upon a catheter which he uses every four hours*. The use of the catheter is becoming increasingly difficult and painful and has already provoked several attacks of double epididymitis. There is present a moderate cystitis. There are evidences of a generalized *arteriosclerosis* with some *mitral insufficiency* and a moderate degree of *chronic interstitial nephritis*. He has also a *double inguinal hernia*. Notwithstanding these many physical defects, he still presents evidences of considerable vital force and, in the opinion of the surgeons, is a reasonably fair operative risk in the face of the marked urinary crises which are developing. Blood-pressure, 220 mm, urinary output, 80 oz, phthalein test, 57 per cent, albumin, a trace.

First Operation—On July 15, 1913, a preliminary suprapubic cystostomy was done by Dr. L. S. Pilcher under local cocaine anaesthesia, using 1 per cent solution of cocaine.

The bladder was exposed in the usual manner without complaint from the patient. Upon opening the bladder a medium-sized *uric acid calculus* the size of a lima bean was detected and removed. A polypoid development of the middle lobe of the prostate perceived. A Pezzer catheter was secured in the bladder and the wound sutured. Patient sustained no shock from the operation. During the following week he remained very comfortable. Urinary output dropped to 30 oz, phthalein test to 18 per cent, etc (see Fig 25). There was a gradual lessening in the blood-pressure and a notable improvement in his general well-being. A phenolphthalein test showed a steady increase in the renal activity.

Consulting the accompanying chart, Fig 25, it will be seen that the blood-pressure had been reduced to 170 and the functional activity of the kidneys had reacted from the first period of depression. The patient's condition was very satisfactory, despite his

began to vomit, 8 hours after operation hiccoughs began and continued intermittently for 24 hours. Second 24 hours urinary output dropped to 27 ounces, still clear, vomiting continued, urine almost solid with albumin. Third 24 hours some nausea, no vomiting. Fourth 24 hours vomiting recommenced. Hiccoughs lasted for 14 hours, quite restless. Urine became bloody, almost solid with albumin—29 ounces in 24 hours. Fourth day very sleepy, hiccoughs continuing, legs showed slight swelling, urine bloody. Fifth day slight hiccough, urine clearer, sat up. Patient showed a gradual improvement with the exception of the swelling in his legs, which increased so that both legs soon became very badly swollen.

Coincident with this no phenolphthalein test was made on account of the large amount of blood and albumin present. June 2, phenolphthalein test showed 30 per cent excretion the first two hours, June 9, one week later, showed 22 per cent excretion first two hours, June 15 showed 21 per cent, July 1, phenolphthalein test showed the excretion to be 48 per cent in two hours. The patient's general condition showed a coincident improvement, swelling of the legs entirely disappeared, the amount of albumin in the urine very greatly decreased so a further operation was deemed advisable.

Second Operation—Transvesical prostatectomy July 5, 1913. Suprapubic catheter removed and with the finger passed into the bladder through the suprapubic opening the prostate was easily removed. There was considerable hemorrhage which necessitated the introduction of packing. Reaction from the operation was very slight. Twenty-four hours after operation was sitting up in bed, 48 hours after operation the drainage tube was removed from the wound and Pezzer catheter re-inserted, 59 ounces were collected through this catheter during the 24 hours, with hardly any leakage. On the fifth, sixth and seventh days he evidenced some stomach irritability and vomited a little, but the attack passed off quickly. On the ninth day began to urinate a little. Wound healed promptly and the patient was discharged cured August 2.

It is not only the kidney and its function which must be considered, but it may be that it is the heart that is the weak link in the chain, and in order to ensure a safe operation the

Second Operation — Transvesical prostatectomy Under ether anæsthesia, the finger was passed through the suprapubic opening and without removing any of the sutures the prostate was enucleated in three minutes. Some packing of the prostatic pouch was necessary to control a moderate hemorrhage. There was no shock following the operation. Draining tube and packing removed in 24 hours and a Pezzer catheter introduced. The Pezzer catheter removed on the fourth day followed by uninterrupted healing of the wound and full restoration of function. Six months after the operation the patient is quite well and is urinating normally.

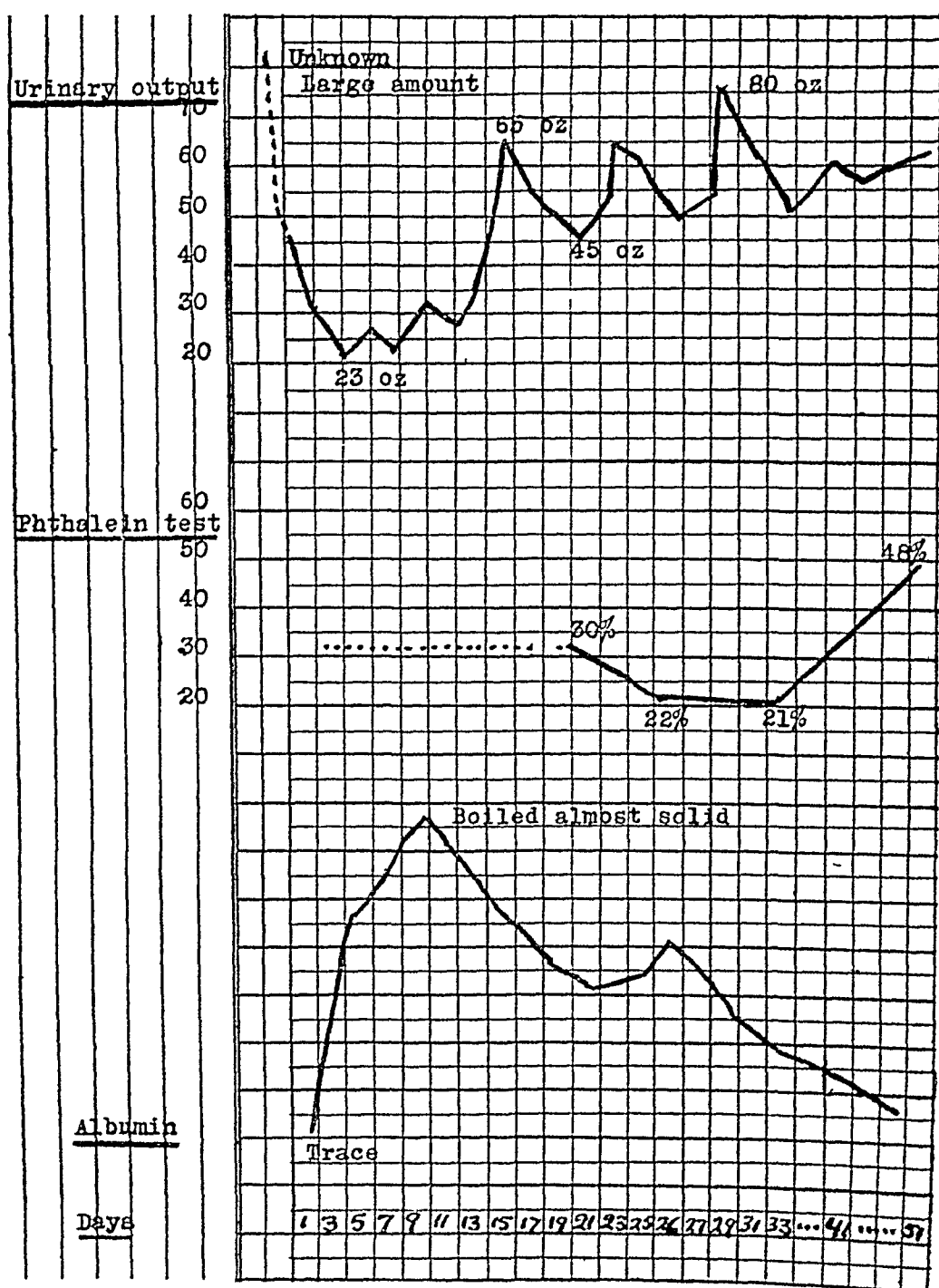
It seems quite evident to us that it was safer ten days after the primary operation to remove the prostate than it would have been at the time of the primary operation. With the blood-pressure of 170 instead of 220, with the kidneys relieved of the disorganization incident to retention of urine, and with a well-balanced functional activity, the prostatectomy could be undertaken without danger to the patient. In our series of cases the depression which occurs from the third to the sixth day has been so constant that it is a real factor to be reckoned with in all these cases, and it is our belief that no prostate should be removed until this period of reaction has been passed.

In some cases the second stage lasts two, three, four or more weeks. During this period after the suprapubic cystostomy all of the clinical features of the case preclude the possibility of a prostatectomy and not until a fully developed third stage appears should the prostate be removed. The following case in which the patient developed a gastric uræmia, and massive œdema of the legs, will serve as an example.

CASE II — Diagnosis Obstructive hypertrophy of prostate, gastric uræmia The patient was admitted May 9, 1913. General health good. Considerable obstruction. No symptoms of kidney trouble excepting a slight amount of albumin which was present.

First Operation — Suprapubic cystostomy, Pezzer catheter May 10, 1913, operation quickly accomplished under local anæsthesia. The day following operation passed 24 ounces of urine, clear, large amount of albumin present, 26 hours after operation

FIG. 26



THE THREE PHASE CYCLE PROLONGED SECOND STAGE

First phase Aside from the large amount of urine passed, the patient's condition was almost ideal

Second phase Which followed the suprapubic cystostomy was unusually severe. Marked diminution in the amount of urine. Urine boiled almost solid. Gastric uræmia supervened. Enormous swelling of the legs. Patient in desperate condition. At the end of 51 days, however, all of the uræmia symptoms had disappeared. Amount of urine passed was normal.

Third phase At end of 50 days phthalein test showed 48 per cent. Urine showed very small amount of albumin. Patient's general condition satisfactory. Prostate enucleated with hardly any post-operative reaction. Patient made perfect recovery.

Growths in the outer hemisphere are likely to cause axillary and supraclavicular involvement earlier than similar lesions in the inner hemisphere; *per contra*, the latter the more surely and the more quickly cause involvement of the liver, mediastinum, vertebræ, and the opposite breast in the order named. From the arrangement of the lymphatic vessels this is just what should be expected. The mediastinum was, until recently, thought to be most obnoxious. Handley has clearly shown the liver to be more so. I am not certain that the mediastinum should even be placed second. My own series indicates clinically a larger per cent of metastases to the bones, particularly the sternum, vertebræ, and long bones than to either the liver or thorax, and gives to them the melancholy distinction of first place. That the liver and lungs may both be more often found involved at autopsy I grant, but this may be, I think is, due to the fact that the abdominal and thoracic cavities are systematically opened and their contents carefully examined, while the osseous system, unless suspected, is not examined. That many metastases to liver and lungs occur subsequently to those in bones I have not the slightest doubt.

Terminal pathology is valuable, but the pathology of the living is far more so, and upon it surgery must advance if it does so at all. Many of my operations have been followed by intercostal neuralgia, paraplegia dolorosa, involvement, with and without fracture, of humerus and femur, before there were either symptoms or signs of abdominal or thoracic complications. A well-taken skiagram will usually locate the lesion.

In August, 1912, I was asked by my colleague, Prof. Anders, to see in consultation a woman from Illinois, who had been operated upon for carcinoma of the breast the preceding November by a distinguished Western surgeon. The patient had come East to spend the summer and had been taken in June, while staying near Boston, with intercostal neuralgia. Nothing seemed to give her relief but opium. Early in August she came to her sister who lives near Philadelphia. When I examined the cicatrix it was found to be smooth, supple, and absolutely free from disease.

third and fourth days very considerable cardiac insufficiency, pulse extremely weak, intermittent and general weakness (see chart, Fig 28), temperature 101.8° , pulse 130, respirations 40 Under

FIG 27

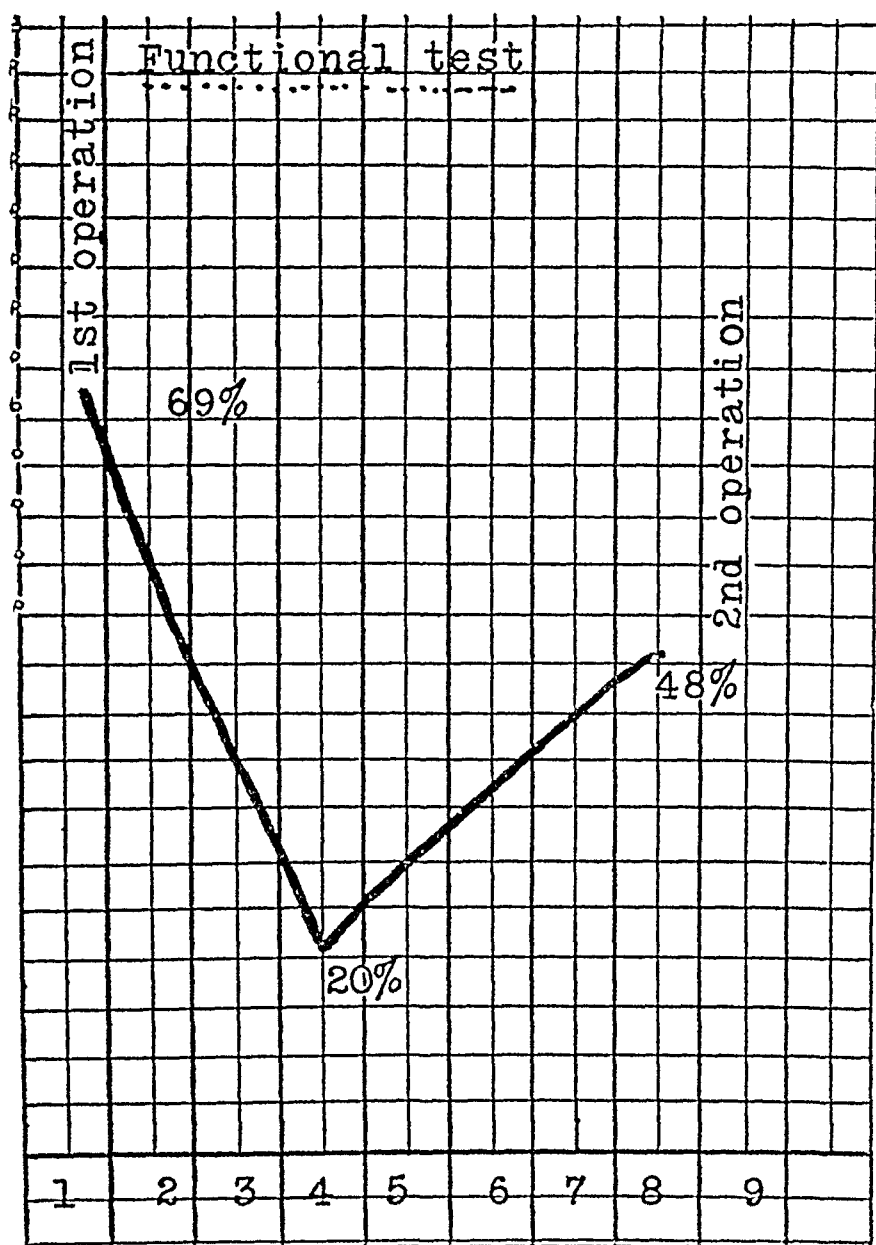


Chart showing drop in renal function during second phase from 69 per cent to 20 per cent. (Case III)

proper medication the conditions gradually returned to normal, which they reached on the fourth day. However, this chart will show the dangerous reaction following the operation which, if it had occurred coincident with the shock of the primary operation

kidney must be in the best possible condition before the enucleation is undertaken, for if, with a failing, dilating heart the renal function fails, there is little hope for the patient's recovery. The following case illustrates this point

CASE III—(Lynch) Patient was a man whose actual age was sixty-five years although his appearance was that of a man of about eighty. For two years he had been struggling against the ravages of prostatic disease and had gradually become emaciated. Was rapidly losing his strength and had already lost his appetite. He had been catheterized frequently, but this had ceased to give relief and at the time of his examination was passing his water every 15 to 20 minutes day and night. As the result of a metal instrument being passed into the urethra he developed an acute retention with bleeding into the bladder. When seen by me he was in greatest distress and the bladder dilated up to the umbilicus. His pulse was small and weak. He was in considerable shock.

First Operation—Suprapubic cystostomy He was hastened to the hospital and immediately the bladder was opened under local anesthesia, and a large amount of blood clot and urine were brought away and a Pezzer catheter sutured into the bladder and the wound closed around it.

The patient reacted very well from the operation. The following day his temperature reached 102°, his pulse 100, urinary output averaged 25 ounces. Renal sufficiency as shown on accompanying chart, which was 69 per cent of phenolphthalein excreted during the first two hours immediately after the operation, dropped on the third day to 20 per cent in two hours under the same conditions. His pulse was weak and soft but not very rapid. His general condition was good. One week later the phenolphthalein test showed an elimination of 48 per cent in two hours (Fig 27). Two days after this, when examined, his condition was considered proper for operation, and under ether anesthesia this was accomplished.

Second Operation—Enucleation of prostate Time of enucleation 1½ minutes. Control of hemorrhage, which was considerable, by packing as above described. The day following the operation patient's condition good. Packing and drainage tube removed. Pezzer catheter inserted. Urinary conditions good. On

with a very marked decrease in the renal sufficiency, the patient would probably have died on the second or third day. As it is the patient recovered entirely, he passed his urine by the urethra on the ninth day, and the wound was closed completely on the twenty-second day. His present condition is satisfactory.

As already referred to, in cases of enormous dilatation of the bladder with oedema of the legs, scrotum, etc., the three-phase cycle shows a remarkable curve when traced on the chart. The accompanying diagram, Fig. 29, shows the condition existing in a patient still under our care. During the first 24 hours the patient passed 249 ounces of urine, a catheter being used to withdraw the amount in small quantities and never emptying the bladder, that viscus being continuously dilated as high as the umbilicus. On the second day more urine was withdrawn at a time and the urinary output was 308 ounces, specific gravity 1002. Following the chart it will be seen that gradually the urinary amount decreased and that on the fourth day the bladder was completely emptied for the first time by catheter, the amount passed during the 24 hours being about 120 ounces. This modified second phase shows a preliminary rise and the enormous output of urine would unquestionably have overwhelmed the patient had a prostatectomy been done, or even a suprapubic cystostomy.

Fig. 30 is the pulse chart of the same patient and shows the remarkable effect the condition had upon the action of the heart. On the twelfth day the phthalein test showed a 40 per cent. output, but the pulse was extremely unreliable. Five days after the suprapubic cystostomy the phthalein test showed an output of 67 per cent. and the pulse at that time would not permit a prostatectomy. In fact, with a heart so badly damaged and a kidney which had been exposed to so much pressure, the date of the prostatectomy must be put off for some weeks.³ Other cases show only a mild degree of depression in the second phase and it would undoubtedly have been perfectly safe to remove the prostate at the first operation, but as yet I have not

* Thirty-eight days after the cystostomy the prostate was removed and the patient has made a good recovery.

FIG. 28

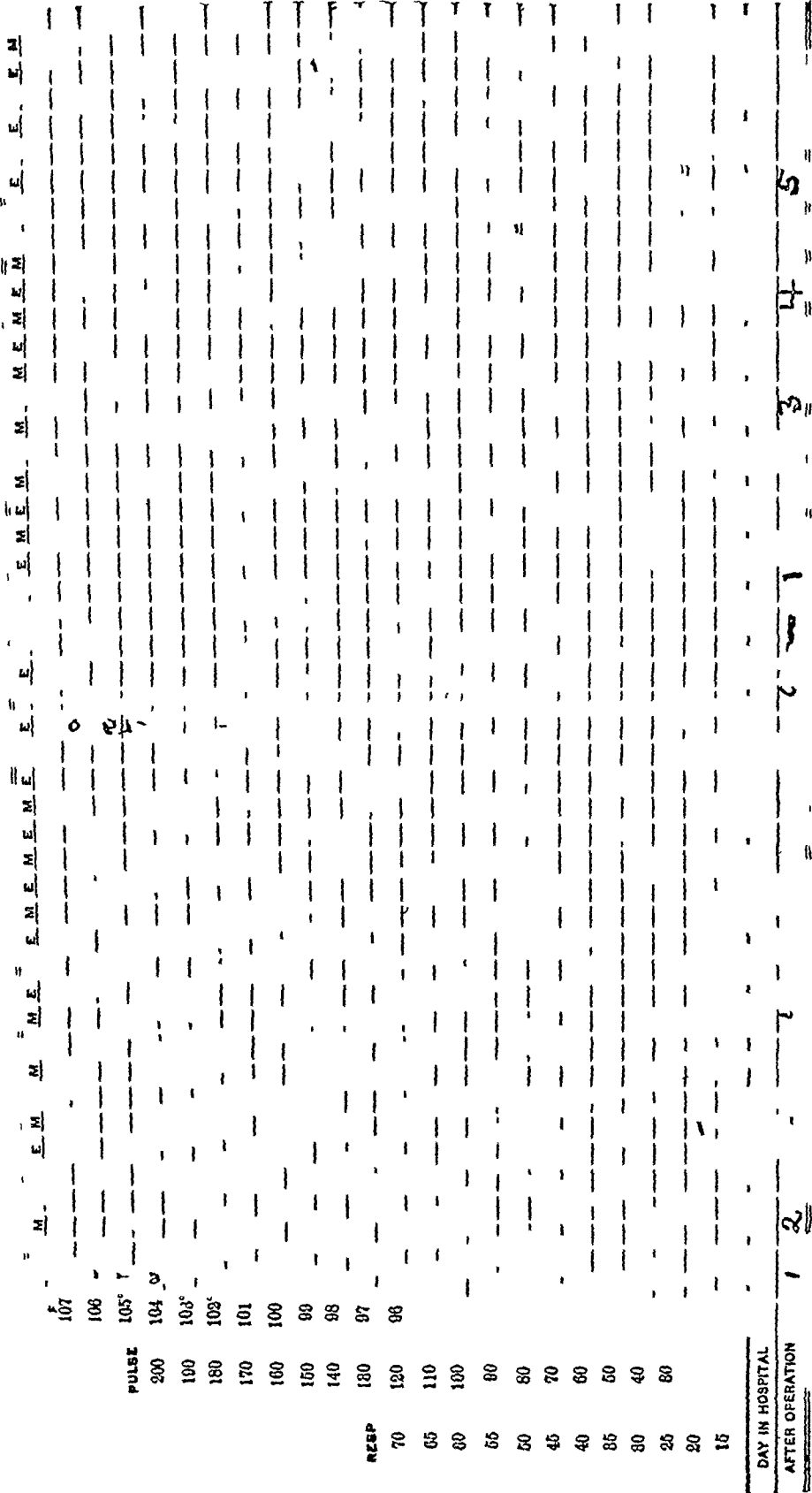


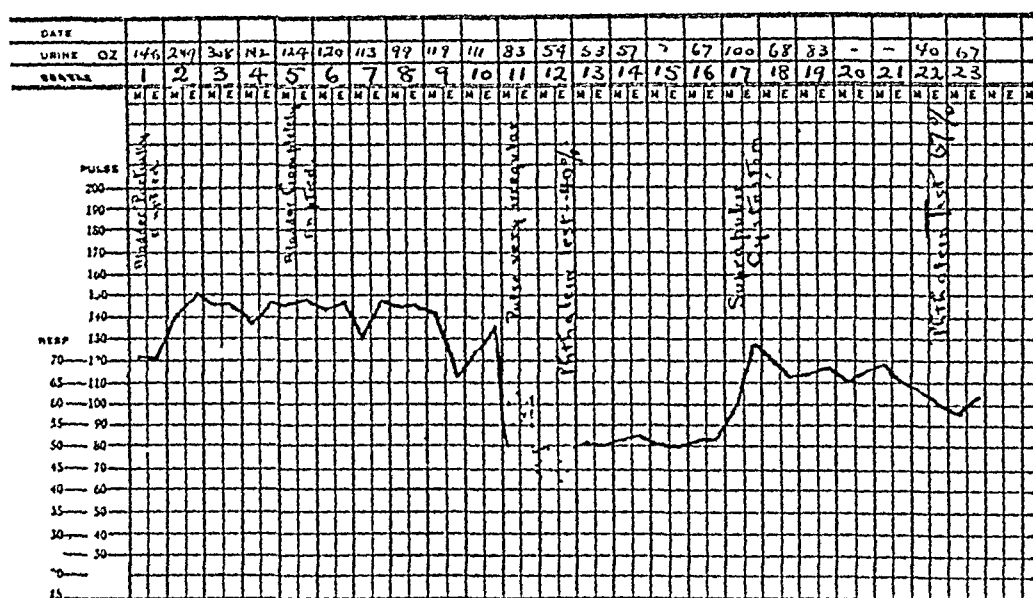
Chart showing pulse, temperature, and respiratory conditions in Case III

been able to tell which cases fall within this class until after the cystostomy has been performed.

How shall we decide, then, when it is safe to remove the prostate in a given case?

First, our judgment is based on the general condition of the patient. When his appetite returns and his sleep becomes normal, when his temperature, pulse and respiration are nor-

FIG 30



Pulse chart of same patient whose urine chart is shown in Fig 29. Partial emptying of the bladder caused pulse to rise to 150 beats per minute. On the eleventh day heart action changed suddenly, as indicated on the chart, and its rhythm and rate were very irregular. The heart balance was gradually established and the suprapubic cystostomy did not disturb it very much.

mal, and when the renal output has returned to normal limits, we consider these a fair index of the general physical well-being of the patient.

Second, we do not advise prostatectomy until all the gross uræmic and nephritic symptoms have disappeared. A moderate amount of albumin in the urine is no contra-indication. The condition of the blood-pressure is also a valuable index.

Third, the phenolphthalein test is of value only as taken in connection with other signs. In the first place, one must consider the results of the phthalein test before the preliminary cystostomy, then the phthalein test taken on the second, third

FIG 29.

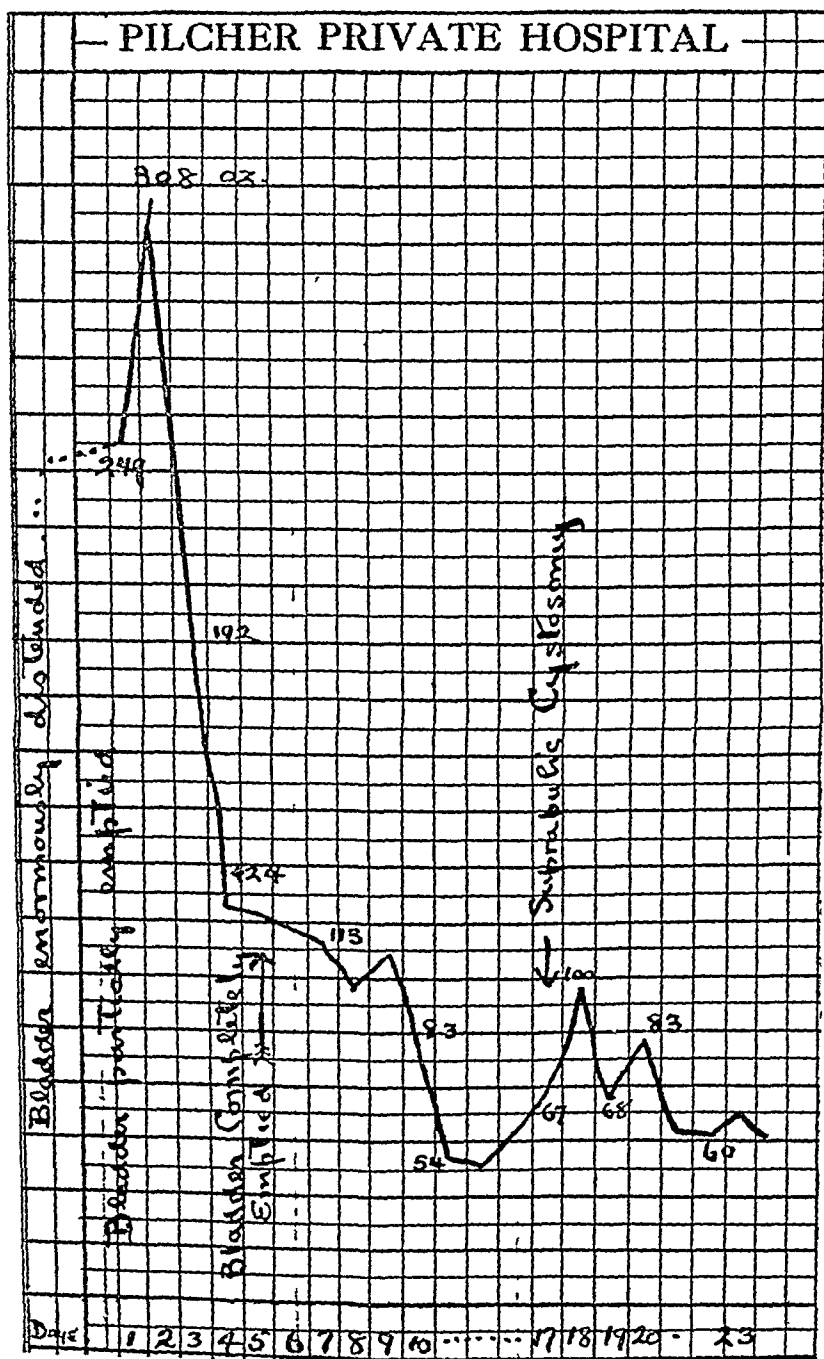


Chart showing remarkable first phase of chronic prostatism. Bladder distended above umbilicus. Patient in collapse. Partial decompression of kidney developed urinary output of 308 ounces of urine in 24 hours. The second phase showed a gradual drop in urinary output with a very marked increase in the amount of albumin. Suprapubic cystostomy on twelfth day showed very slight reaction from kidney. For the first twelve days, urine was removed by catheter.

ually withdrawn and, depending upon the amount present and the amount secreted by the kidney, the amount drawn should be regulated.

It is an interesting fact that the control of the amount of residual urine in cases of enormous distention of the bladder will regulate the output of urine through the kidney. In connection with these cases no drugs should be given to stimulate the heart or change its action until there is some very absolute indication for the same, for harm may be done, preventing the establishment of a normal balance, as the heart adjusts itself to the new conditions found in the kidney.

IV SUPRAPUBIC CYSTOSTOMY.

First step, preparation of the patient. Skin, usual iodine preparation. Anæsthesia, novocaine 2 per cent by preference. Incision, vertical.

Technic of Operation.—Usual incision beginning just above the pubis is made through the skin and superficial fascia. The sheath of the rectus is divided in the median line, the recti muscles are separated, exposing the prevesical fat and fascia. The muscles are held apart by a specially devised retractor, modified from the Mayo-Collins appendectomy retractor. The advantage of this retractor is that the curved blades are in a straight line at the point where they enter between the muscles, and after they are entered they present a concave surface to the muscular face which they wish to retract, which keeps them from slipping out of the wound. Then the third arm of the retractor is placed later. When the prevesical space has been exposed, the finger is entered until it reaches the superior surface of the symphysis. With this as a landmark, the finger covered with gauze is used to strip the fascia and lymphatic tissue from the anterior wall of the bladder. It is often of advantage to have the bladder partially filled with water, for then it is somewhat easier to clean off the anterior surface of the bladder with the finger. This stripping away of the tissue with the finger is carried up to the peritoneal fold. The peritoneum is not disturbed unless it

or fourth day, and third, the functional reaction of the kidney to this test at the end of a week or ten days. It is a mistake to rely entirely upon this test, especially before the cystostomy has been done. For example, the test may show excretions of more than 50 per cent in the first two hours before the preliminary cystostomy, but the reaction may drop on the second or third day, after relief of the retention of urine, to below 15 per cent, which is a true index of the functional capacity. When, however, the period of depression is passed and the reaction returns to 50 per cent after the retention of urine has been relieved, this then becomes a fair index of what we can expect the kidney to do after the prostate has been removed.

CATHETER DRAINAGE OF THE BLADDER—There are some cases in which catheter drainage of the bladder must be used as a preliminary to the suprapubic cystostomy, such as cases where there is an enormous distention of the bladder with oedema of the legs, scrotum, and penis due to pressure. If a cystostomy is done and all of the urine is withdrawn at one time from the bladder, the shock and decompression of the kidney thus occasioned may bring on a fatal uræmia or a fatal hemorrhage. One such case was seen by the writer at the Jewish Hospital in Brooklyn where the bladder, which was enormously distended, was suddenly emptied, the patient promptly died. A second case under the care of the writer at St. John's Hospital, in which 72 ounces of urine was withdrawn from the bladder, was followed by a dangerous hemorrhage into the bladder.

1 *Indications for Catheter Drainage*—Some operators prefer to use catheter drainage for a week preparatory to every transvesical prostatectomy. It is always indicated in cases where the residual urine amounts to 30 ounces or over.

2 *Dangers*—Sudden withdrawal of all of the urine may cause death from shock, uræmia or hemorrhage. The presence of a catheter in the urethra may occasion infection, and in a number of reported cases death has followed its use.

3 *General Rules*—If catheter drainage is established, the bladder should not be emptied all at once, but the urine grad-

She was nearly five months advanced in pregnancy when she was operated upon in the Jewish Hospital, in November, 1905. She had a typical scirrhus of the left mammary gland with moderate axillary involvement. At the present time, nearly eight years after operation, she is perfectly well.

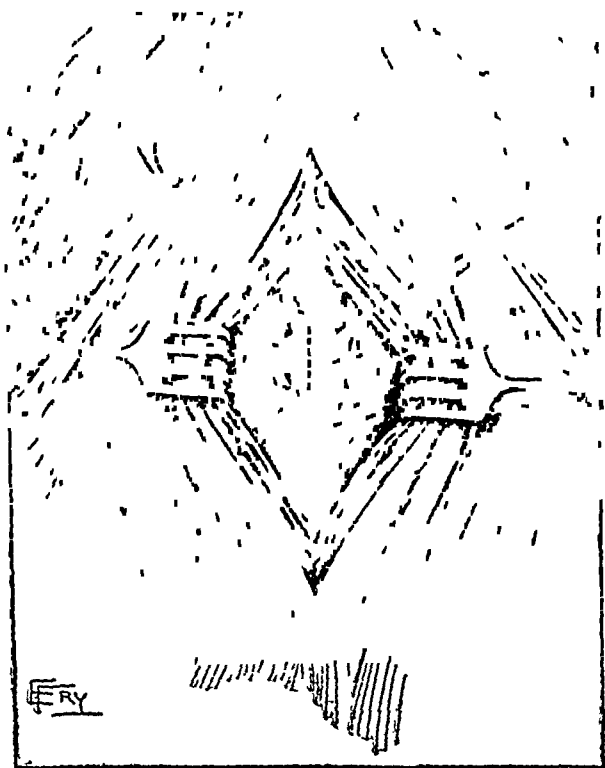
That metastases to axillary and even supraclavicular glands may occur very early, and not in young women either, is shown by the report of another case. A maiden lady, fifty-six years of age, was sent to me for operation on June 3 last. She had not the slightest knowledge of any trouble in her breast until five weeks previously. At that time there was a slight induration in the upper and outer quadrant of the right breast about one and a half inches from the nipple. It was painless. Very soon the entire breast became involved and three weeks later she consulted her physician. There was no history of trauma at any time. At the time when she visited me the entire mamma was involved, skin red, and its local temperature very much increased. It looked like an acute inflammation, as shown by the photographs and drawing which I had made. The axillary glands were greatly enlarged, so much so as to cause moderate oedema of the arm. There was also a lump in the subclavian triangle as large as an English walnut. The breast was adherent to the costal wall. The opposite mamma was quite normal and the axilla as well. It was recognized as a typical example, and the most acute one I have ever seen, of what Volkmann has described as carcinomatous mastitis. I declined to operate, as all of the four cases I had previously seen and operated on died, three of them within six months and one in fifteen months. A two weeks' trial of X-rays was made, at the end of which time she being no better but worse, radium treatment was begun. She was only able to take a few treatments, as her general condition grew rapidly worse. The entire breast became, so her physician Dr. Bird tells me, "as purple as an egg-plant." She died August 9, just three months after the disease was first recognized.

We have said that the location of the growth and its variety influence axillary and other metastases. Adenocarcinoma has little tendency to cause metastases, glandular or otherwise. Encephaloid or medullary cancer does so quickly. Scirrhus stands midway between them.

reaches far down over the anterior surface of the bladder. If this is so, the peritoneum is stripped up somewhat. With the bladder surface freely exposed, the third arm of the retractor is placed over the bit of gauze to hold up the fat covering the peritoneal fold.

Securing the Bladder—To hold the bladder in place a silverized catgut retention suture is passed through the wall of

FIG 31



Second step in the preliminary cystostomy. The bladder wall is seen exposed and the position of the incision is indicated near the fold of the peritoneum. The two stay sutures are in place and hold the bladder wall up. As soon as these sutures have been introduced the fluid is withdrawn from the bladder.

the bladder near the point at which the bladder is to be opened (Fig 31). The water is then withdrawn from the bladder through the catheter and the bladder washed clean. Then holding the wall of the bladder out through the abdominal wound, a knife is thrust into the bladder. The knife is withdrawn and the finger enters the bladder and examines the interior of the bladder to determine the presence of stone or

the same By this method this step of the operation is already completed before the prostatectomy is attempted

Whatever shock is going to take place from this encroachment on the urinary apparatus in cases of prostatic hypertrophy will become evident on the second to the fifth day after the suprapubic cystostomy The *patient is in the best possible con-*

FIG 32



Shows the way in which the Pezzet catheter is fixed into the bladder wound —the stay suture from one side being tied on the opposite side of the tube including some of the bladder wall and the one from the other side tied in a similar manner These will hold the tube firmly in place A purse-string suture is used for the same purpose

dition to overcome this shock because there has been no loss of blood, no general anæsthetic, and no special pain, all of which factors tend to decrease the resisting powers of the organism Almost without exception in cases where there has been any great retention, there is a marked renal reaction which occurs during the first week, as previously noted If this, then, can be eliminated as a factor of the prostatectomy itself, it seems to us that it is our duty to do this

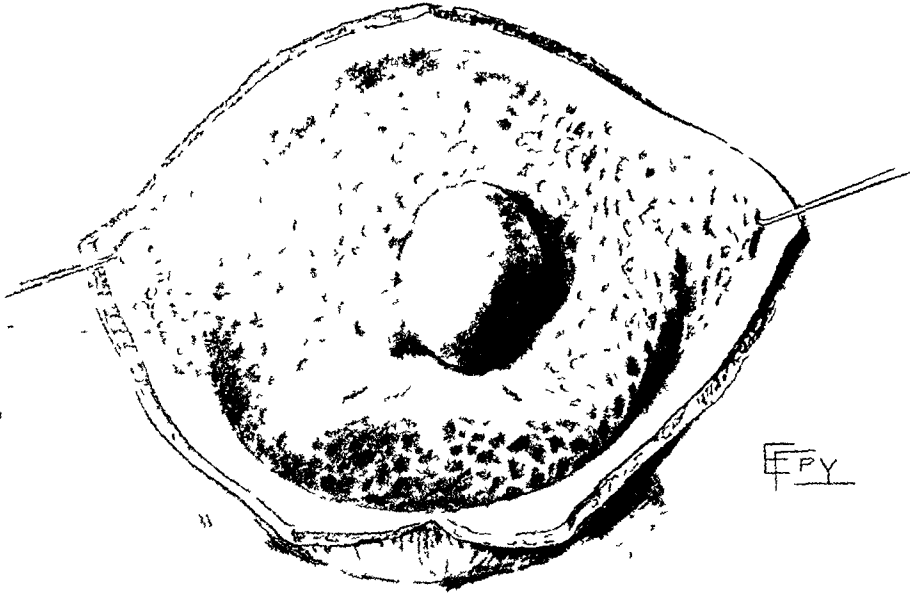
any foreign body A foreign body, if present, is then removed The condition of the prostate and its conformation and general character is then studied with the finger The only point at which the patient will complain of pain is when dragging on the bladder wall or when examining the bladder with the finger through the bladder wound Examination of the interior of the bladder can be done quickly The finger is then withdrawn and a Pezzer catheter is inserted into the bladder wound (see Figs 32 and 33)

The Point at Which the Bladder is to be Opened—Incision into the bladder is made as near the peritoneal fold as possible, for healing takes place more rapidly at this point, and when a fistula is formed, the urine enters the fistula less easily at this point.

Draining the Bladder—The Pezzer catheter, as mentioned before (Fig 33), is fixed in the anterior wall of the bladder, then, using the same suture that was placed for the retraction suture, a purse-string is made in the bladder wall around the catheter This suture is of catgut It is tied, being careful to tuck in the muscular wall of the bladder around the catheter This produces a slight spur in the interior of the bladder which, after the catheter is removed, favors early healing This suture when tied insures a water-tight joint around the Pezzer catheter The wound is then reconstructed. The prevesical space is carefully obliterated by the catgut suture The fascia and muscles are sutured together with chromic gut The skin is sutured with silk In other words, all of the planes of tissue are brought together again in their natural position and the only opening is the line through which the catheter emerges. It is possible to do this in these cases because the joint around the Pezzer catheter is water-tight and there will be no leakage for over a week The result is that *we have a primary union of the wound, a thoroughly drained bladder and the first step of our transvesical prostatectomy already completed*

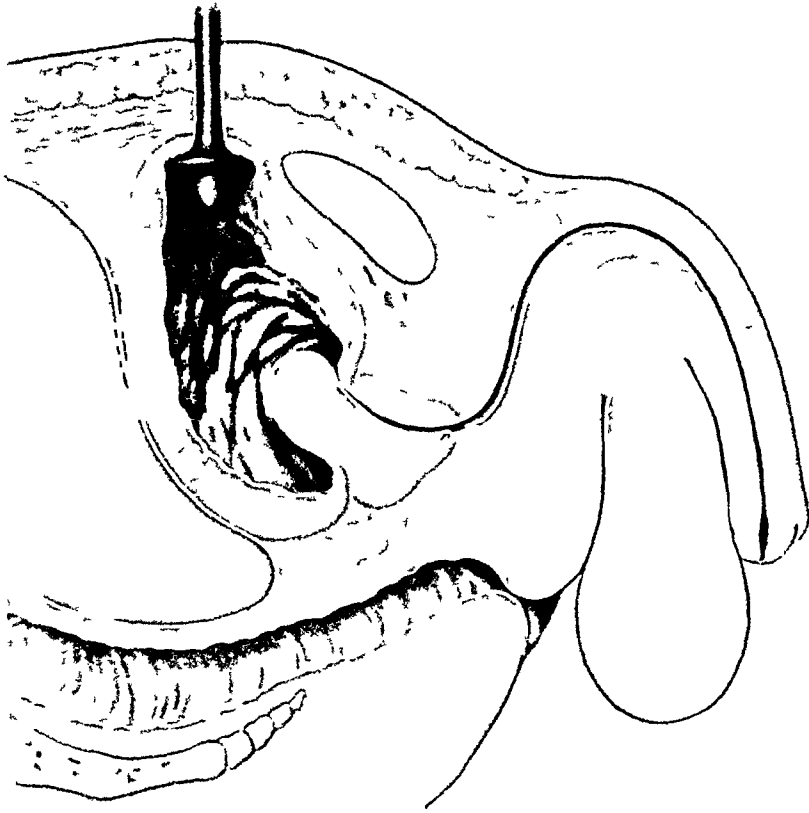
In any transvesical prostatectomy most of the time will be consumed in making the suprapubic incision and in closing

FIG 35



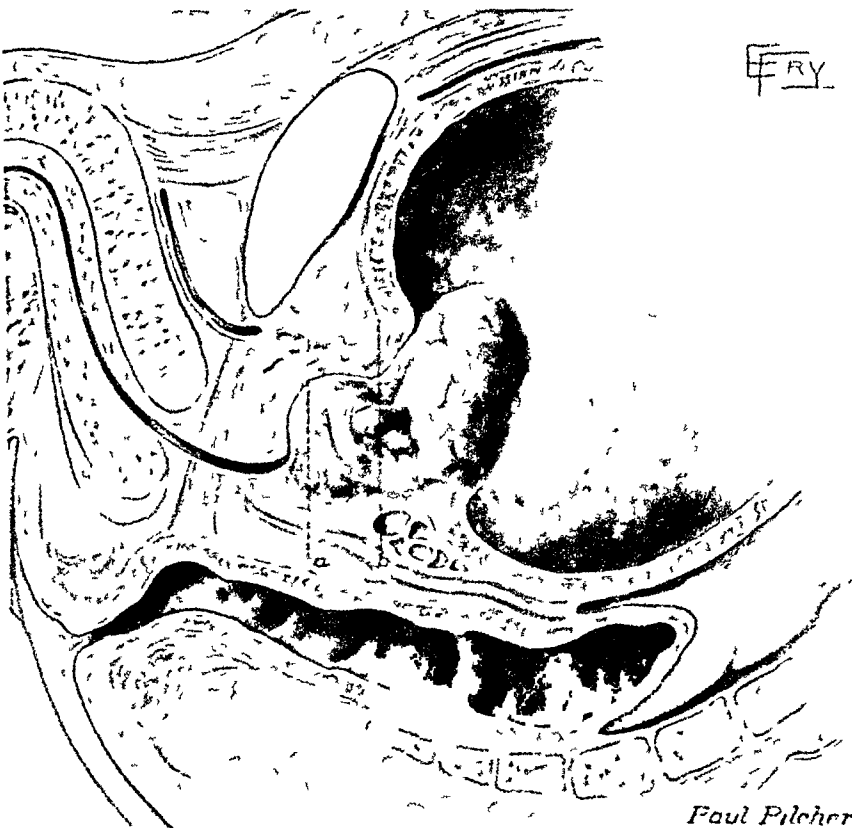
Illustrates a second view of the vesical aspect of a hypertrophied prostate showing the irregularity of the outgrowth and emphasizing the fact that the prostatic hypertrophy is a lesion of the bladder and not of the perineum

FIG 33



Pezzer catheter in place after suprapubic cystostomy. Button of the catheter fits snugly and is far superior to the ordinary drainage tube inasmuch as it does not permit any rough or sharp surface to irritate the prostate or the bladder wall. This idea was first suggested to me by Rovsing and is the method which he follows.

FIG 34

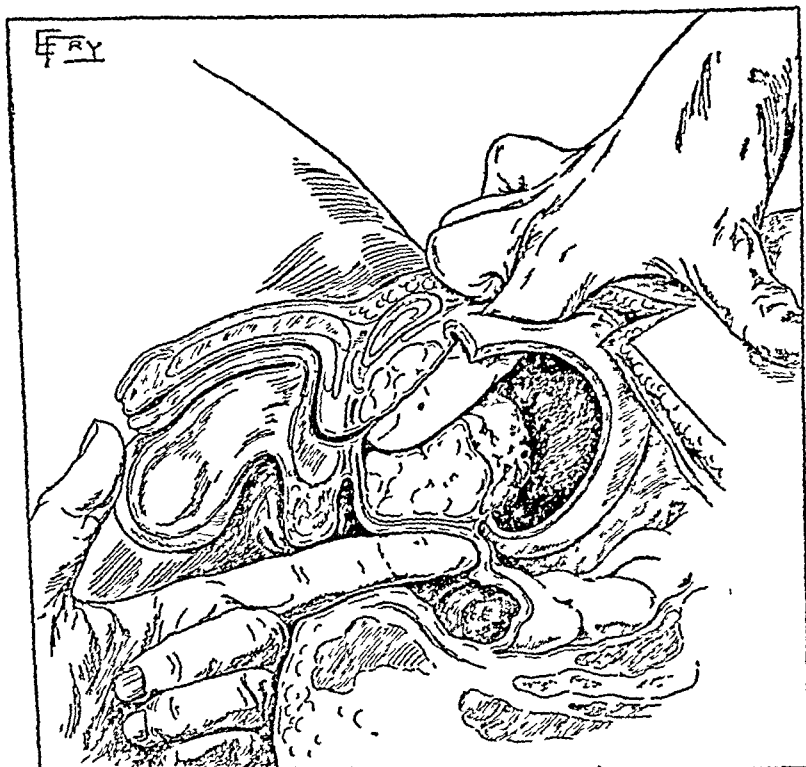


The surgical problem. The picture presented illustrates the average case of prostatic hypertrophy with a special development of the median lobe. It is shown to emphasize the bearing of the surgical pathology upon the choice of method of operation.

the preliminary cystostomy using the Pezzet catheter, it will be found that the wound surrounding the catheter has healed by primary union. *The silk sutures are still in place. These are not removed, for they are needed to hold together the recent wound while the finger is enucleating the prostate.*

First step The skin is prepared with iodine. The Pezzet catheter is removed and the *gloved finger* introduced into the

FIG 36



Transvesical prostatectomy. Enucleation of the prostate. Usual method. Finger is introduced into the urethra and advanced as far as possible before breaking through the urethral mucous membrane. Usually the line of cleavage is easily found from the urethra and the enucleation is accomplished as described in the text.

bladder through the suprapubic opening. This opening easily dilates sufficiently to allow free manipulation of the finger. The index finger of the other hand is introduced into the rectum and the prostate is lifted up.

Second step Enucleation of the prostate. The index finger of the enucleating hand is introduced into the prostatic urethra and advanced as far as possible, reaching, if possible, the furthest point of the prostatic enlargement. This method,

Two other methods have been devised as the first step of the transvesical enucleation. First, the use of a permanent catheter. This question has already been discussed (p 528). The objections to it are. In the first place, it is most disagreeable to many patients; in the second place, it almost invariably excites a urethritis which frequently causes an infection of the epididymis, and sometimes affects the testicle. These are unfortunate complications. In the third place, fatal sepsis has more than once followed the using of a permanent catheter in old men with prostatic disease.

One method used as a substitute for the suprapubic cystostomy in emergency cases is the puncture with a trocar above the pubis. This is not without danger in the hands of some surgeons, to say the least, and it does not in any way shorten the major operation.

My chief argument, however, is that by doing a preliminary suprapubic cystostomy we accomplish everything that any of the other methods do, we are able to do it under a local anæsthetic, we have exposed the suprapubic tissues to infection and, if this takes place, which is a very rare occurrence in these cases, it may be overcome and will subside before enucleation of the prostate is undertaken. Again, as the result of the preliminary cystostomy, the œdema and swelling around the neck of the bladder, including the prostate, greatly diminish. I have seen the prostate diminish one-half in size after the suprapubic cystostomy alone. This is of advantage in the enucleation and the healing of the wound.

V THE TECHNIC OF TRANSVESICAL PROSTATECTOMY.

When it has been proven to the surgeon's satisfaction that the prostate can be safely removed, judging from the functional test of the kidney compared with the original functional test and taking into account the amount of urea excreted and the evidences of acute or chronic renal disease, as well as the general condition of the patient, as previously stated, the operation may be undertaken. The patient is prepared as for any other operation. When the dressings are removed, after

the prevesical tissue The finger is then passed across the urethra to the other side with a sweeping motion of the finger and the opposite lateral lobe is freed Then passing the finger up over the entire mass an attempt is made to turn the growth over so that it will easily turn out into the bladder carrying with it the median lobe (Fig 37) That is to say, the finger is passed up over the two loosened lateral lobes and then beneath the same between the enlarged lobes and the rectum, and then

FIG 39



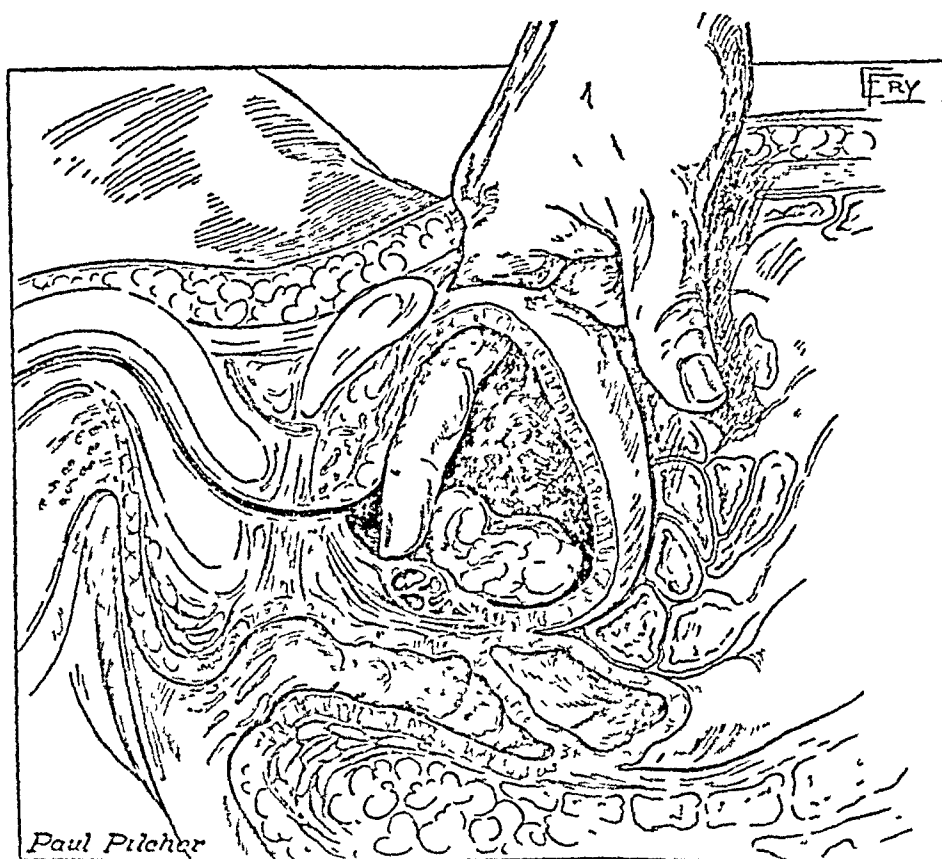
Drawing illustrating method of removing a massive hypertrophy of the prostate where the urethral enucleation is impracticable This is applicable in the large bilateral hypertrophies The illustration shows the finger raising up the sphincter, enucleating the prostatic mass in one piece

the finger is pulled toward the bladder so that the growth will turn upon itself, as is shown more clearly in Fig 37

As the growth is turned out into the bladder, the bladder mucous membrane will be stripped up from the posterior side of it, as may be seen in Fig 38 The point which is most difficult to free is the attachment at the junction of the prostatic and membranous urethra, which is seemingly a fibrous attachment, or may be the attachment to the atrophied posterior lobe which lies distal to the ejaculatory ducts and which prob-

as shown in Fig 36, is especially useful in two forms of prostatic enlargement, that which is due to an irregular enlargement of both lateral lobes, and that which is due to enlargement of both lateral lobes and the median lobe, even though the median lobe be enlarged out of all proportion to the other two lobes, as in Fig 3. With the finger in the prostatic urethra, the point of least resistance in the mucous membrane of the urethra is sought. Usually this will be found on the lateral or the antero-

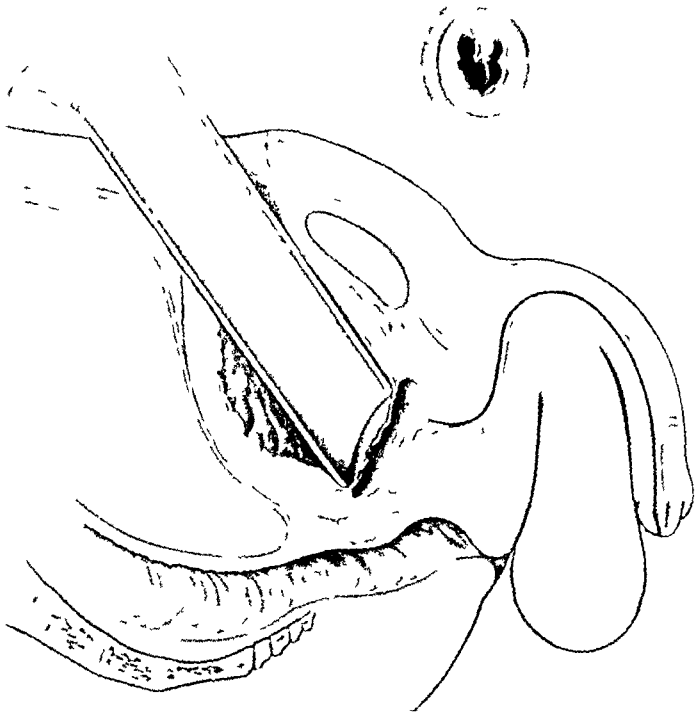
FIG 37



Drawing illustrating one of the final steps in enucleation of the prostate. The lateral lobes have been freed and the mass together with the median lobe is being turned over and turned into the bladder, stripping up the mucous membrane of the bladder from the surface of the prostate.

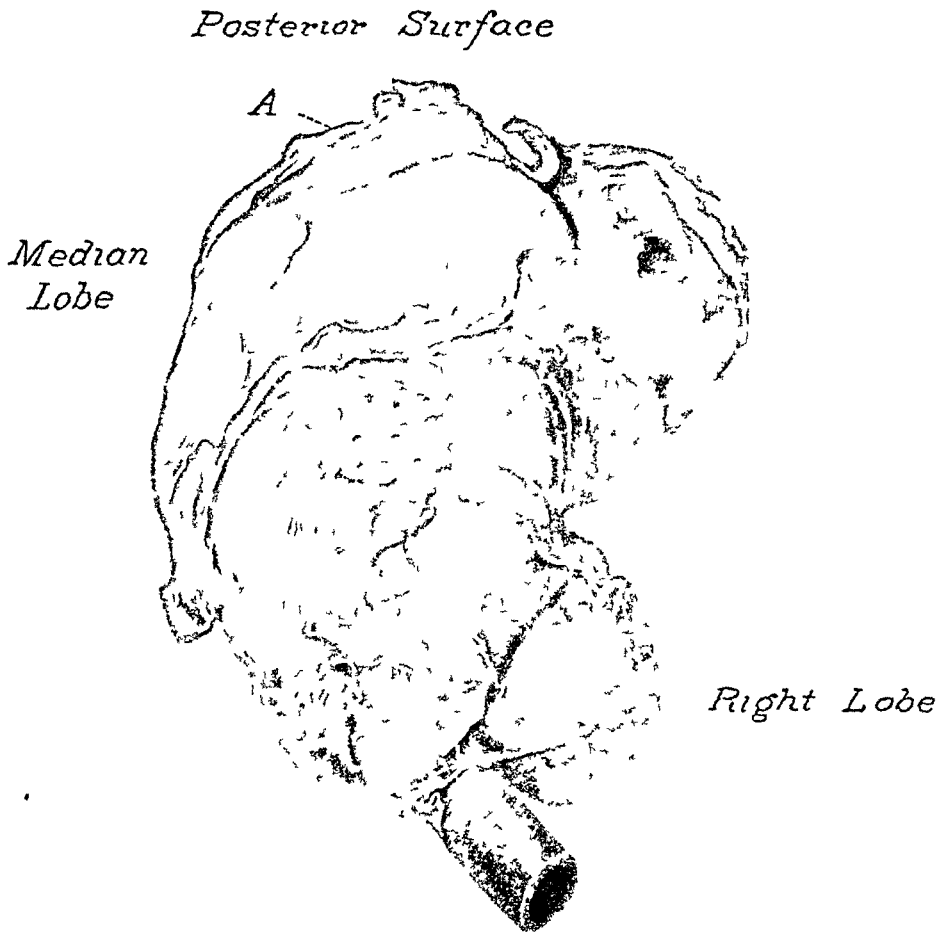
lateral wall of the urethra. At this point the division between the prostate and the urethra is usually quite easily broken through. In all of my recent cases I have been able to gain the line of cleavage through the urethra easily with the gloved finger. The finger after entering the line of cleavage sweeps, first, slowly around the distal portion of the growth, and then, up over the anterior surface of the growth separating it from

FIG 40



Illustrating the method used by Fenwick to control hemorrhage after prostate had been removed. Small picture in upper right hand corner shows condition frequently found for a small blood vessel which seemed to be bleeding contained in the torn edges of the bladder mucous membrane. Illustration shows the speculum in place with the neck of the bladder exposed that the operator may directly clamp any bleeding vessel. This method in the hands of Fenwick is ideal.

FIG 38



Paul Pilcher.

Under surface of prostatic mass showing the enormous median lobe and the small right lobe
' 4 ' shows the torn edges of the mucous membrane stripped up from posterior surface

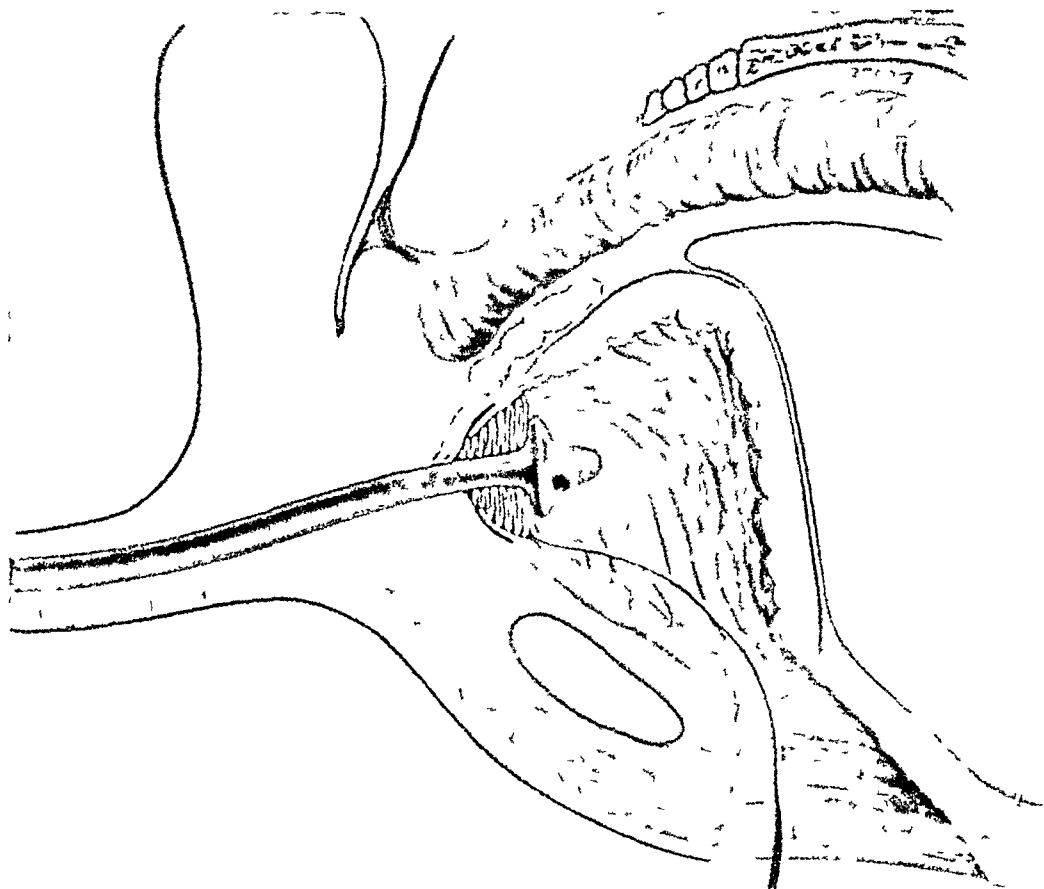


FIG. 11

Showing method of controlling hemorrhage by the use of packing. The Pezzet catheter is introduced by first passing a silver catheter through the urethra and out through the suprapubic wound attaching the Pezzet catheter to the silver catheter and withdrawing same of narrow gauze introducing it in such a way that the torn mucous membrane flaps of the bladder are pushed ahead of the packing and when the packing is in place the Pezzet catheter is pulled down keeping the packing in place and exerting pressure against the bleeding surface at the same time. In order to hold the Pezzet catheter firmly in place, it should be attached to the leg by adhesive plaster. The gauze is removed after 24 hours and the catheter it will

Growths in the outer hemisphere are likely to cause axillary and supraclavicular involvement earlier than similar lesions in the inner hemisphere, *per contra*, the latter the more surely and the more quickly cause involvement of the liver, mediastinum, vertebræ, and the opposite breast in the order named. From the arrangement of the lymphatic vessels this is just what should be expected. The mediastinum was, until recently, thought to be most obnoxious. Handley has clearly shown the liver to be more so. I am not certain that the mediastinum should even be placed second. My own series indicates clinically a larger per cent of metastases to the bones, particularly the sternum, vertebræ, and long bones than to either the liver or thorax, and gives to them the melancholy distinction of first place. That the liver and lungs may both be more often found involved at autopsy I grant, but this may be, I think is, due to the fact that the abdominal and thoracic cavities are systematically opened and their contents carefully examined, while the osseous system, unless suspected, is not examined. That many metastases to liver and lungs occur subsequently to those in bones I have not the slightest doubt.

Terminal pathology is valuable, but the pathology of the living is far more so, and upon it surgery must advance if it does so at all. Many of my operations have been followed by intercostal neuralgia, paraplegia dolorosa, involvement, with and without fracture, of humerus and femur, before there were either symptoms or signs of abdominal or thoracic complications. A well-taken skiagram will usually locate the lesion.

In August, 1912, I was asked by my colleague, Prof. Anders, to see in consultation a woman from Illinois, who had been operated upon for carcinoma of the breast the preceding November by a distinguished Western surgeon. The patient had come East to spend the summer and had been taken in June, while staying near Boston, with intercostal neuralgia. Nothing seemed to give her relief but opium. Early in August she came to her sister who lives near Philadelphia. When I examined the cicatrix it was found to be smooth, supple, and absolutely free from disease.

ably is not removed in the majority of cases. It has been our experience that *those cases in which the prostate does not shell out easily should be carefully examined for evidences of malignancy.*

The other type of prostate which is occasionally met with is the enormous prostate which seems to be hypertrophied in all its parts with the exception of the median lobe. Such a prostate is seen in Fig. 12. In removing this prostate it may often be more completely and more easily done by passing the finger between the sphincter vesicæ and the growth itself and sweeping the finger around the growth, as recommended by Freyer. It will quickly fall out into the bladder. This method of enucleation is illustrated in Fig. 39. However, in the majority of cases the intra-urethral enucleation is to be preferred. It is quite essential for the welfare of the patient that all of the prostate as far as possible shall be removed. Thus, Fig. 6 shows a prostate with a very large median lobe and two moderately enlarged lateral lobes, with many pieces of prostatic tissue which were dug out from the capsule after the main growth had been removed. The operator should never be satisfied with removing the larger adenomatous mass alone, but an attempt should be made to bring away all the prostatic tissue possible unless there is a diffuse carcinomatous involvement. If fragments remain, they retard the healing of the cavity from which the prostate has been removed and are apt to necrose and cause a delay in the healing of the bladder.

Third step. Removing the prostatic sections and the blood clots from the bladder. A pair of forceps is passed through the suprapubic wound and the pieces of prostate which have been turned out from the bladder are carefully removed. All of the blood clots in the bladder should be washed out so that no pieces of foreign material are left behind.

Control of the Hemorrhage.—A number of methods have been devised for controlling the hemorrhage.

First, the Fenwick method by clamp and ligature. Fenwick has devised a series of three specula of different sizes which may be introduced through the suprapubic wound, bringing

Appearance of suprapubic scar two weeks after the operation. It is meant especially to show the clean appearance of the wound which is entirely free of incrustations or sloughs



Fig. 42

This consists of introducing a catheter through the urethra which serves as a guide and centre around which the packing is to be placed. Then a narrow strip of gauze packing is introduced through the suprapubic wound and the torn edges of mucous membrane which have been stripped up from the prostate are pressed down into the shallow prostatic pouch and held in place by gauze packing, as is shown in Figure 41. This shows the prostatic pouch exaggerated with the torn flaps of mucous membrane pushed before the gauze packing and in addition the Pezzer catheter used to hold the gauze packing in place. This Pezzer catheter may be introduced by first passing a silver catheter through the urethra and out from the suprapubic wound and then attaching the small end of the Pezzer catheter to the silver catheter and drawing it out through the urethra. With the expanded end of the catheter on the vesical side of the packing, considerable pressure may be brought to bear, using a very small amount of gauze packing by pulling on the penile end of the catheter. Up to the present time we have always used the simple rubber catheter as a guide and centre around which to pack the gauze. The end of the gauze is led out through the abdominal wound (Fig 41). Other methods of controlling hemorrhage by direct pressure have been devised, but none of them are superior to those which have been mentioned.

Control of Secondary Hemorrhage from the Bladder.—*Hemorrhages occurring within 12 to 24 hours* after the prostatectomy are best controlled by packing the prostatic pouch around a catheter introduced through the urethra. In one case the writer passed a silk suture through the perineum, placed a gauze packing over the prostatic pouch and fastened the silk suture to this gauze packing, tying the same on the outside of the perineum. *Secondary hemorrhage which occurs a week or so after the operation* may be either from the wound itself which calls for re-opening the wound and suture, or may be from the vesical neck or the prostatic pouch itself. Such an occurrence calls for re-opening of the bladder, exposure of the bleeding point and securing same either by suture, the actual

the area from which the prostate has been removed directly into view. The use of one of these speculum is illustrated in Fig 40. The headlight is used to illuminate the cavity. With the lacerated oozing area in view and properly illuminated, the area is sponged as dry as possible and it will be found, as a rule, that *bleeding does not come so much from the cavity from which the prostate has been removed, but usually from the free edges of the lacerated tissue* which covers the surface of the prostate on its vesical aspect. This was very beautifully demonstrated to the writer by Mr Fenwick himself. In one case he was able to show me a spurting vessel in this free edge. He demonstrated further that the area from which the prostate has been removed flattens out very quickly and does not remain as a cavity, but retracts down and, as a rule, does not allow space for the accumulation of blood clots. Through the speculum the bleeding points are caught with specially devised hæmostats. In this way, as a rule, the bleeding can be entirely controlled. In most cases after a few minutes crushing with the hæmostats they may be removed and no further bleeding will occur. The hæmostats are so constructed that the handles may be removed, if necessary, and left *in situ* for 24 hours.

As a modification of this method, the writer would suggest the use of the actual cautery through the speculum to control any bleeding point which might come into view.

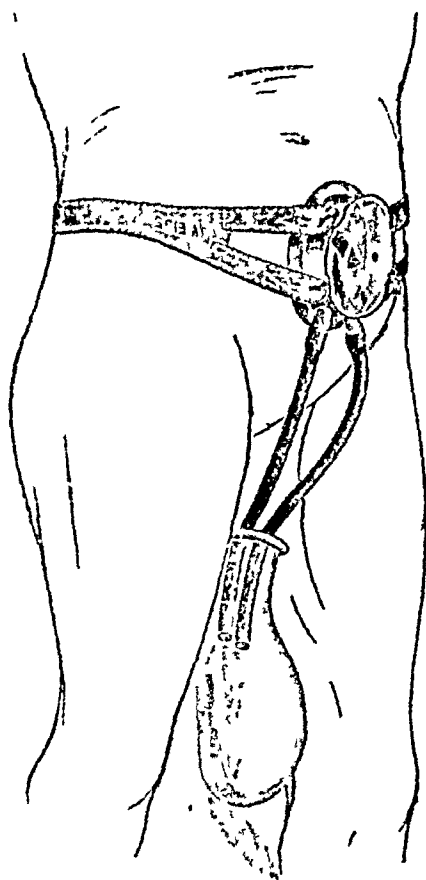
Second, control by suture. A number of prominent operators complete their prostatectomies by surrounding the area from which the prostate has been removed by a continuous catgut suture. This necessitates a large suprapubic wound and consumes considerable time and, in the experience of the writer, has never been found necessary.

Thrd, control by pressure. With one finger in the rectum and a finger in the bladder the tissues involved in the prostatic wound may be pressed together and in this way much oozing will be prevented. At the last meeting of the American Urological Society in Boston, April, 1913, the writer presented a method of controlling hemorrhage, using gauze packing⁴

⁴ Pilcher *Transactions of the American Urol Soc*, 1913, vol vii, p 57

vent the formation of sloughs and phosphatic concretions on the wound surfaces (Fig 42). Also, the use of drugs to prevent alkalinity of the urine will tend to give a better wound. *On the fourth or fifth day* the Pezzer catheter is removed and is replaced by a collecting device of an English maker, which is shown in Fig. 43. The wound is strapped with a piece of inch-wide adhesive tape and what urine escapes is

FIG 43



collected in the celluloid cup and drains from the cup into a bottle through a rubber tube. This ingenious device is held in place by rubber straps which keep it from slipping. It is a very convenient and comfortable adjunct to the convalescence. If the suprapubic cup is not available, the use merely of masses of absorbent gauze over the fistula will answer any need until the fistula closes and normal urethral urination is re-established.

The period of healing of the suprapubic wound has in our experience taken from one week to four weeks, *the average be-*

cautery or the high-frequency spark generated from the D'Arsonval current. In one case of my own, it was necessary after the second week to re-open the bladder widely and cauterize the entire area of the vesical neck before the hemorrhage could be stopped.

Drainage of the Bladder After Transvesical Prostatectomy—To the mind of the writer, it is very essential to drain the bladder suprapubically after every case of prostatectomy. We consider it dangerous and unnecessary to run the risk of closing the bladder after transvesical prostatectomy. This has been emphasized in our own experience in two cases in which we closed the bladder and were compelled to re-open and drain the bladder on account of severe hemorrhage within the bladder which clogged the urethral catheter. Our routine is, as soon as the prostate is removed and the hemorrhage checked, to introduce a large rubber drainage tube, one inch in diameter, just within the wall of the bladder, and after securing it in place to apply copious gauze dressings over the same. If the packing of the prostatic pouch is necessary, a small gauze packing is brought out through the large drainage tube. It should be emphasized at this point that none of the silk skin sutures introduced at the primary operation have been removed, and that after the enucleation of the prostate no suturing of the wound is necessary. The cystostomy wound made at the first operation is capable of very great distention without tearing it open if the original sutures have not been removed.

After-treatment—As soon as the patient has been returned to his bed a proctoclysis of tap water is begun and the abdominal dressings changed as frequently as necessary. After 24 hours the bladder is irrigated through the suprapubic tube which is still in place. If packing is in place it is removed, together with the large suprapubic drainage tube. The Pezzer catheter replaces the suprapubic drainage tube. It will be found that in six to eight hours the bladder wall will contract around the Pezzer catheter and very little urine will leak out beside it. The Pezzer catheter is left in place for three or four days until the wound surfaces have healed over. This tends to pre-

the catheter through the urethra, and the operation of transvesical prostatectomy is already half completed

Fourth, since applying these principles we are able to report to date 28 successive successful cases, every case resulting in the control of urine by the patient and his ability to empty the bladder without using a catheter. In some cases of enormous distention of the bladder, it is necessary to catheterize for a certain length of time before employing suprapubic cystostomy on account of the extreme back pressure on the kidneys, the sudden decompression of which might result fatally.

Fifth, these same rules do not apply in cases where carcinoma of the prostate has been diagnosed, or even where its presence is fairly well suspected. A later communication will deal with this part of the subject.

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ing about 16 days In none of our cases has there been any permanent suprapubic fistula. The nearest approach to it was in the case of recurrent secondary hemorrhage in which the bladder was twice widely opened in order to control the hemorrhage. In one case the suprapubic wound closed in four days.

Control of the Urine—About the eighth to tenth day, as a rule, small amounts of urine will pass *per urethram*, the amount increasing as the suprapubic wound contracts. It is worthy of note that in none of our recent cases has dribbling been noticed, and that within two or three weeks after the operation the patients have fairly good control, and in all the cases operated upon by us after this method the result has been full control of the urine with complete emptying of the bladder.

Potency of the Male—This operation does not seem to interfere with the functions of the ejaculatory ducts, in fact, in a number of instances the potency has increased as a result of the operation.

CONCLUSIONS

Studies of the living pathology of chronic prostatism lead us to the conclusion that obstructive prostatic hypertrophy usually involves the two lateral lobes and the median lobe, and that inasmuch as the obstruction is at the neck of the bladder and the obstructing body projects into the bladder, the natural avenue of approach is the transvesical route.

Second, as a result of relieving the distention of the bladder, three phases of kidney secretion are demonstrable, the second phase, lasting from a few days to a number of weeks, constitutes a period of danger during which no surgical attack should be undertaken.

Third, the technic advocated in the present paper includes a two-step transvesical operation in every instance for the relief of benign hypertrophy of the prostate. Preliminary cystostomy is preferred for the reason that, following the suprapubic cystostomy the patient is out of bed in 24 hours, the urinary output from the bladder is completely controlled, there is no unpleasantness or traumatism due to the passage of

Her only symptom was intercostal neuralgia. A careful examination of her back led me to believe that certain vertebræ were affected, and I gave her sister and husband a very guarded prognosis, plainly stating my fears. A skiagram was made the following day by Dr Pfahler which served to confirm my opinion. The operator was at once written to for further information. His report showed an early scirrhus, and that a favorable opinion as to a radical cure had been entered in his notes. He was in every respect warranted in thinking so at the time, and certainly had done a very complete operation. During the next month the patient was, I learned, better, then worse alternately. Soon after her return home in October, or less than a year after operation, she died. Spinal metastases had taken place before operation and could not have been suspected. There is no other rational explanation of this case and the following ones in my own practice which are briefly outlined.

One of them, a married woman of thirty-two, was operated on in May, 1908, and died December, 1910, thirty-one months after operation. To the very end the cicatrix and surrounding structures were absolutely normal. Intercostal neuralgia began within a year after operation, and a palpable tumor of the spine, apparently beginning in the intervertebral disc between the eleventh and twelfth dorsal vertebræ followed later, a skiagram of which is shown. At the time of her death, from reports made to me, it must have been enormous. Strangely enough she did not have paraplegia, as the growth was forward instead of backward. She could not walk well, however, for a year before her death.

In January, 1909, I operated on a married woman, thirty-nine years of age, for a well-marked scirrhus with pronounced, but not extensive, axillary involvement. During the meeting of the Congress of American Surgeons two years ago she was one of thirty cases exhibited to show the post-operative result. Although the scar was perfectly normal, so was the axilla, and she had gained in weight, looked perfectly well and was doing all of the cooking and housework for herself and family, she reported to me that she was not sleeping well on account of a pain in her side at night. A careful examination convinced me that it was intercostal and probably the result of metastasis to a vertebra which was tender upon pressure. A skiagram was made the following day which

THE NORMAL BLADDER AND ITS SPHINCTERS AND THE CHANGES FOLLOWING SUPRA- PUBIC PROSTATECTOMY

A STUDY BASED ON RADIOGRAPHIC FINDINGS

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INCONTINENCE of urine following prostatectomy is encountered infrequently, and very rarely after suprapubic enucleation, it is more often met with after the perineal operation. The cause of this condition has not been definitely determined. The object of this study is to inquire into the mechanism of urination following suprapubic prostatectomy and to note the changes in the topography of the bladder resulting from this operation. It was believed that by such an investigation additional light would be cast upon the question of post-operative incontinence of urine.

As a preliminary it was deemed advisable to make a number of observations of the normal bladder, and of the condition of the bladder in prostatic enlargement, in order the better to correlate the findings.

THE NORMAL BLADDER

A résumé of the literature dealing with the mechanism of the sphincters of the normal bladder shows that considerable discrepancy of opinion still exists concerning the rôles played by the internal vesical sphincter and the external sphincter, or compressor urethræ muscle.

A brief description of the anatomy of the bladder and its

* Read before the American Urological Association, New York Society, December, 1913

course, varies according to the skeletal development, the musculature, the age of the patient and the condition of the neighboring organs; for it can readily be seen that tumors, congenital defects, prostatic enlargement, and other pathological conditions influence its location. According to Langer,³ the internal urethral orifice in a normal, slightly-filled bladder is between 2.2 and 4.5 centimetres from the posterior aspect of the symphysis. As the bladder distends the orifice is pushed downward. Richet locates the internal sphincter on a line from the under border of the symphysis to the fourth sacral vertebra, while Kohlrausch⁴ places it on a line from the upper border of the symphysis to the tip of the coccyx. All these observations were made upon the cadaver.

The contour of the normal bladder has long been the subject of much discussion. Most of the work in this connection has been carried out upon the cadaver by means of different methods. The bladder has been filled both from the urethra and from the ureters with wax, plaster of Paris, formalin and other solutions, it has been inflated with air, and has also been studied by means of frozen sections. As a result of these investigations the bladder has been variously described as being cylindrical, ovoid, elliptical or spheroid. It is evident, however, that the bladder is not equally distensible, for if it were so, its shape when filled would be round. Furthermore, Langer has carefully demonstrated that the region of the outlet is the least distensible, especially so at the trigone. His observations are borne out by the fact that in the markedly distended bladder there is but slight variation in the distance between the two ureters.

In 1905 a new method of studying the form of the bladder was devised by Volcker and Lichtenberg.⁵ They employed collargol injections combined with radiography, and as a result of their work concluded that the normal bladder when distended is invariably broader above than below, and is never round. Subsequently Leedham-Greene, using the same technic, reported that the radiographs he obtained showed the bladder to be oval in shape. His photographs, however, demonstrate a bladder round in form. More recently two articles have

sphincters may aid in understanding some features to which I shall subsequently refer. Although individual opinions vary, it appears to me that Leedham-Greene¹ presents the best summary of the standard anatomists, and I will therefore quote from his description:

"Anatomists while differing considerably in minor details, describe three more or less distinct constrictor muscles in connection with the bladder and urethra, though their opinions differ greatly as to the part these muscles play in maintaining the closure of the bladder. They are as follows:

"*A* A slender ill-defined ring of oblique muscular fibres intermingled with elastic tissue, encircles the vesical opening, and is formed of unstriped or involuntary muscular tissue. According as to whether it is regarded as belonging to the bladder proper or to the prostate, it is called the internal vesical 'or internal prostatic' sphincter.

"*B*. Below the internal sphincter some short transverse muscular fibres are present on the anterior or ventral surface of the lower or distal half of the prostate. They rapidly increase in length as they approach the apex of the prostate until they completely encircle the urethra. The majority of these fibres, chiefly composed of voluntary muscular tissue, are situated on the outer surface of the prostate. All these fibres together comprise the external prostatic or vesical sphincter of Henle, which according to Griffiths² is merely the commencement of the constrictor urethræ.

"And lastly, surrounding the membranous urethra, contiguous to the anterior portion of the external prostatic sphincter is that muscle, or group of muscles, best known as the compressor urethræ."

It is well recognized, that but two of these muscles are of importance in the act of micturition, the smooth muscle, involuntary internal vesical sphincter, and the striated voluntary compressor urethræ.

Concerning the topography of the normal bladder the following may be said. The most fixed portion of the bladder is the outlet, being firmly held by its attachments to the prostate and urogenital musculature. The position of the sphincter, of

recent writers (Ruggles,¹⁵ Wilson and McGrath¹⁶) basing their opinions on the older methods of study continue to adhere to the belief that the compressor urethræ muscle is of paramount importance in retaining the urine in the fully distended bladder. Thus to quote one of these authors, Ruggles, "We all know, or ought at least, that the vesical sphincter is a comparatively weak muscle and that the only muscles by the action of which we are enabled to resist a strong desire to urinate is the external sphincter or compressor urethræ, which is a strong voluntary muscle."

The method of Volcker and Lichtenberg—collargol injections combined with radiography—offered the best physiological method of studying this much discussed question, and conclusions reached by its application appear to me to definitely solve this problem. As previously stated, Volcker and Lichtenberg showed that the bladder is broader above, narrowing down at the outlet, they also demonstrated in their collargol radiographs that the internal vesical sphincter is the sphincter that prevents the escape of fluid from the fully distended bladder, and they never observed a funnel-shaped formation. Later investigators (Leedham-Greene, Barringer and MacKee, Uhle and MacKinney) using a similar technic substantiated their findings. Oppenheim and Loew¹⁷ are the only observers who maintain that the closure takes place at the compressor urethræ. Their work, however, was done on monkeys, using bismuth injections, furthermore, their radiographs were rather indistinct in outline and by no means conclusive.

Before proceeding with the details of the work, I wish briefly to state that my observations on the normal bladder are in the main in concordance with the work of Volcker and Lichtenberg.

TECHNIC AND RESULTS OF RADIOGRAPHIC EXAMINATIONS OF THE NORMAL BLADDER

These radiographic studies were begun two years ago. In the beginning three different positions were tried, the ventro-dorsal (patient lying flat on back), the dorsoventral (patient on

appeared dealing with this subject; in the first, by Barringer and MacKee,⁶ the results obtained coincided with those of Volcker and Lichtenberg; in the second, by Uhle and MacKinney,⁷ the radiographs more closely resembled the round form of Leedham-Greene.

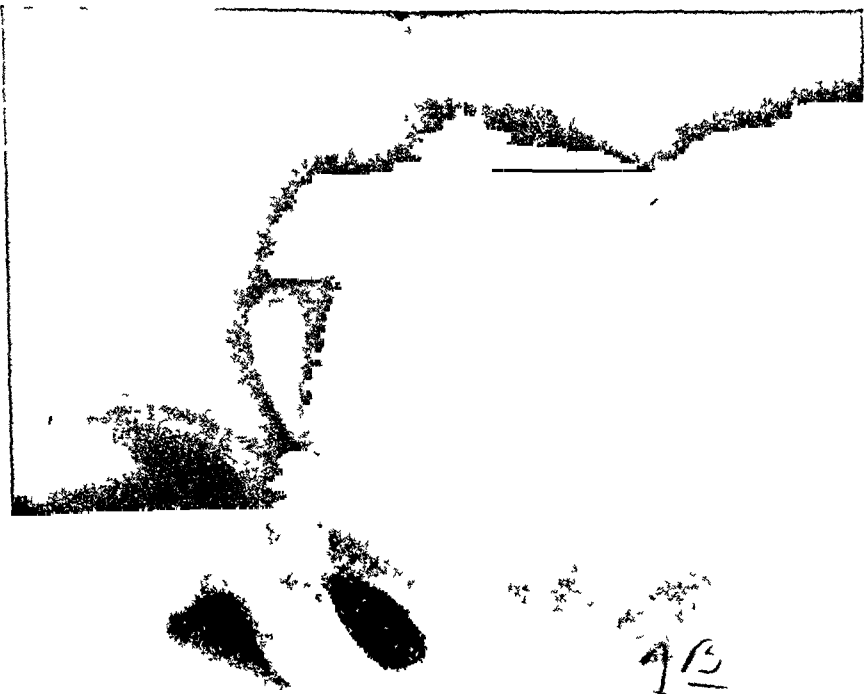
Turning now to the action of the sphincters when the bladder is fully distended, a study of the literature again discloses considerable difference of opinion; all authors, however, are agreed that in the moderately distended bladder it is the internal vesical sphincter that is active in retaining the urine. This diversity of opinion is due in part to the different methods employed. The earlier investigators worked on the cadaver. Thus Born,⁸ using ureteral injections of plaster of Paris, found that the closure took place at the internal vesical sphincter. From a series of anatomical studies Kohlrausch believed that folds of mucous membrane which he found near the internal urethral orifice acted as the sphincter. Barkow⁹ termed the internal urethral orifice, the annulus elasticus, and considered that the sphincter. Henle,¹⁰ however, showed that the action of this sphincter was not due to elastic fibres, but to smooth muscle, so that this constituted a true sphincter. Later anatomists and clinicians making their studies on animals and the living human being placed the seat of vesical closure at the external sphincter, the compressor urethræ muscle. Guyon,¹¹ Ultzman,¹² Finger¹³ and many others were of the opinion that in the distended bladder the internal sphincter was not of sufficient strength to retain the urine. They believe that when the bladder is distended the posterior urethra becomes part of it, forming a funnel-shaped outlet, with the closure taking place at the compressor urethræ muscle. These authors base their arguments in part upon the fact that in the fully distended bladder the urethra is from one and one-half to two centimetres shorter than when the bladder is but moderately filled. v. Zeissel,¹⁴ however, believes that this shortening is not sufficient to justify placing the closure at the compressor urethræ, for if this were so there should be at least four centimetres shortening; that is, the length of the prostatic urethra. More

FIG 3



Normal bladder of same patient as Fig 2 taken in dorsoventral position, showing but slight variation from preceding one

FIG 4



Normal bladder distended with 420 c.c. of collargol. Approaches round type of bladder. Urethra sharply demarcated.

FIG 1



Normal bladder distended with 150 c.c. of collargol, showing broad upper portion, narrowing at outlet

FIG 2



Normal bladder distended with 225 c.c. of collargol

FIG 7



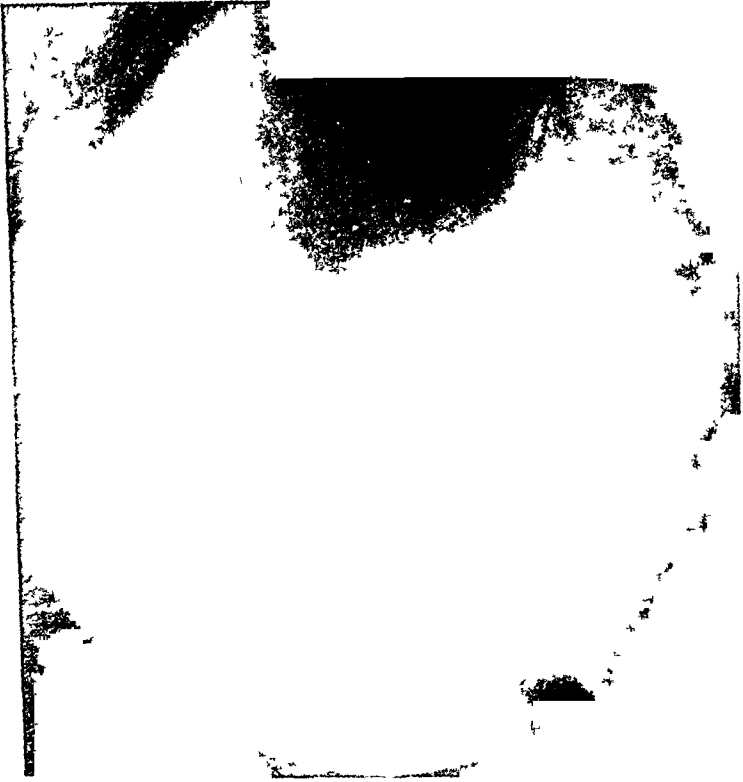
Bladder in prostatic hypertrophy, distended with 200 c c collargol. Numerous irregular shaped diverticulæ present

FIG 8



Bladder in prostatic hypertrophy, distended with 240 c c collargol, showing peculiar elongated shape

FIG 11



Bladder in prostatic hypertrophy distended with 300 c c of collargol showing bulging and irregularity of base

FIG 12



Bladder following suprapubic prostatectomy 10 months after operation, showing a small funnel shaped formation

FIG 9



Bladder in prostatic hypertrophy distended with 250 c.c. colloidal shows high location above symphysis broad flat base with urethra sharply demarcated

FIG 10



FIG 10 shows the bladder in prostatic hypertrophy distended with 250 c.c. colloidal. The bladder is high located above the symphysis, broad flat base, with urethra sharply demarcated.

FIG 2

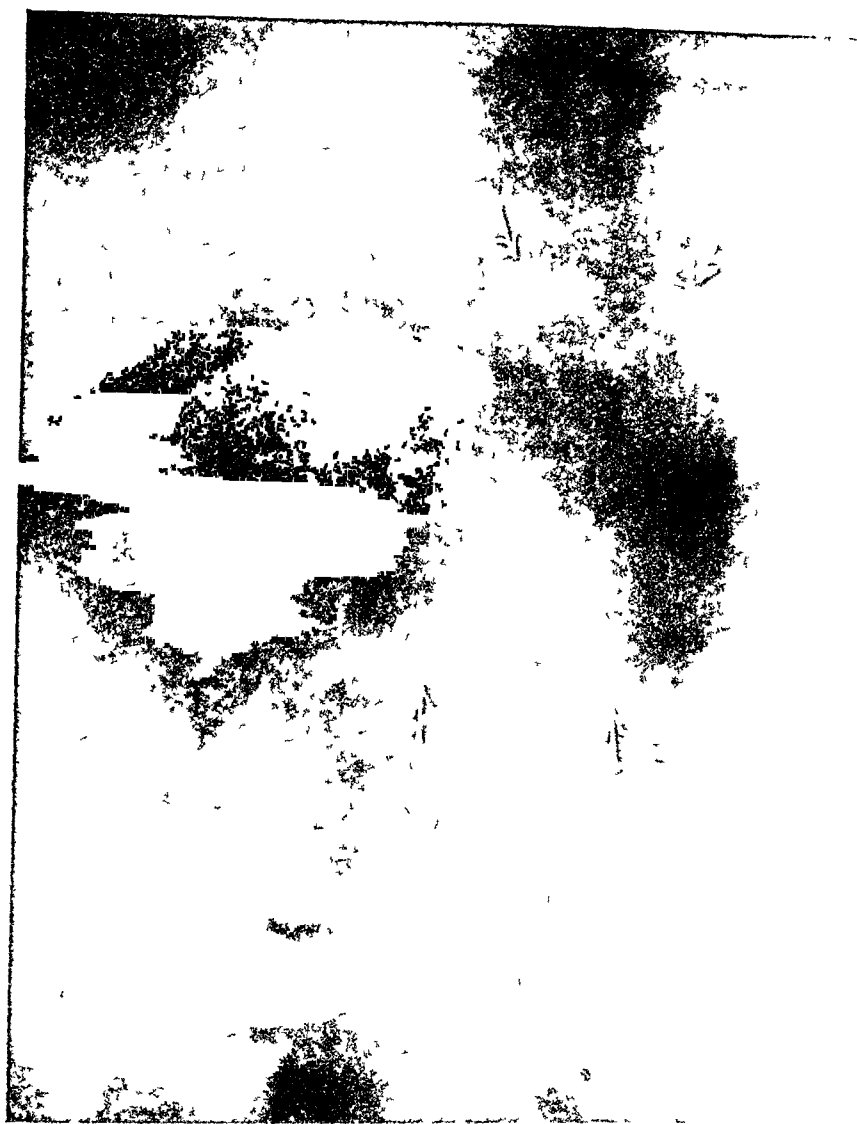


Fig. 15

Bladder following suprapubic prostatectomy, 1 1/2 year after operation showing similar condition

Fig. 17

Bladder following suprapubic prostatectomy 1½ years after operation, showing collargol in cavity below and continuous with the bladder



FIG 16

Bladder following suprapubic prostatectomy, 1½ years after operation, showing collection of collargol in cavity below and continuous with the bladder



abdomen), and the lateral. The lateral views were very unsatisfactory owing to the density of the muscular and bony structures of the pelvis. The dorsoventral and ventrodorsal gave practically the same results, and the latter, the ventrodorsal position, because more convenient was adopted as a routine. The position of the X-ray tube is of considerable importance. The earlier radiographs were taken with the tube placed posterior and obliquely to a vertical plane passing through the symphysis pubis. It was found, however, that this position failed to give a good view of the outlet of the bladder. Subsequently, therefore, the tube was placed so that its focus was at a right angle to the plate, the rays striking the body just above the symphysis. A compression blend was used; but moderate compression was applied, however, so as not to distort the bladder. The medium used was a 5 per cent solution of collargol which in the large majority of cases was found to be non-irritating. The solution was introduced through a catheter which was then withdrawn.

Twelve radiographic exposures of normal bladders were made and as the main object was the study of the sphincteric region, the bladders were fully distended.

The shape of the normal bladder was found to be variable, although the type most frequently encountered was that showing a broad upper portion, narrowing down toward the outlet. A few of the pictures closely approached the round type described by Leedham-Greene, while twice the bladder assumed an ovoid shape with the long diameter extending from the fundus to the base. Leguen¹⁸ has recently described a reverse type, the bladder broad below, and narrow above, as characteristic of the normal bladder with the patient in the prone position. This type was not observed in any of the cases in my series. In the radiographs the urethra was invariably found to be sharply demarcated from the bladder, thus demonstrating that the internal vesical sphincter is the muscle that retains fluid in the distended bladder. The position of the internal sphincter was either on a level with the upper border of the symphysis pubis, or midway between the upper and lower borders.

Bladder following suprapubic prostatectomy 5 years after operation, showing large collection of collargol in cavity below and continuous with the bladder



Fig 19

THE CONDITION OF THE BLADDER FOLLOWING SUPRAPUBIC PROSTATECTOMY.

The mechanism of sphincteric control after prostatectomy is still imperfectly understood. Very few references to this subject are to be found in the literature, and the opinions expressed are not in accordance. Thus Hagner and Fuller²⁰ in a recent publication state, "that the cause of the loss of control after prostatectomy is a debatable question. It is unquestionably due to the destruction of the muscle at the neck of the bladder, in the prostatic urethra, or in the membranous urethra." Squier²¹ is of the opinion that the internal sphincter remains intact and soon contracts to its normal calibre. Other authors, however, have placed the seat of bladder closure following operation at the compressor urethræ muscle. Thus Freyer,²² reporting an autopsy upon a patient who died twenty-two days after operation, found the bladder pear- or funnel-shaped, instead of globular, the inner surface of the urethra terminating at the triangular ligament. In a personal communication, Lilienthal states that he believes that the compressor urethræ forms the true sphincter of the bladder after prostatectomy.

As far as can be ascertained from a review of the literature but few attempts have been made to study the bladder after prostatectomy by means of radiography. Wallace,²³ using a bismuth suspension, reported one case in which a skiagraph of the bladder was taken. His description is as follows: "The skiagraph shows the bladder cavity continuous with the cavity from which the prostatic adenomata were removed. As the prostate had a distinct intravesical projection the internal sphincter must have stretched considerably. Its situation is presumably at or just distal to the ledge or shelf forming the separation between the two cavities. If this presumption is right, the internal sphincter could not have had any effect in controlling the urine and it must be supposed that a man can have normal micturition without an efficient internal vesical sphincter." Another case, reported by Legueu, confirms Wallace's findings.

THE BLADDER IN PROSTATIC HYPERTROPHY

Before beginning a study of the condition of the bladder following prostatectomy, it was considered desirable to take a series of radiographs on unoperated cases of enlarged prostate, in order to better determine the changes following the operation. Marked changes in the contour of the bladder were observed in these unoperated cases. They varied from the small contracted bladder to the larger, irregular, flaccid type. Vesical diverticulæ, so frequently encountered in prostatic enlargement, were distinctly shown in several instances. Changes characteristic of prostatic enlargement are to be found at the base of the bladder. Instead of a broad upper part narrowing at the outlet, the opposite picture was seen. The inferior portion of the bladder was broad and flat or sinuous, at times an upward bulging, due to the gland projecting into the bladder, was observed. This flattening of the inferior portion of the bladder may be said to be characteristic of prostatic enlargement. The bladder was situated on a higher plane than in the normal, the level depending upon the size of the gland. Its base was found to be opposite the upper border of the symphysis, or more often one to two centimetres higher. The prostatic lobes could not be definitely demonstrated radiographically.

The question of sphincteric control in prostatic enlargement seems to me to be decisively settled by the radiographs Wallace,¹⁹ in a recent publication, writes, "When a prostate enlarges the adenomatous mass sometimes makes its way through and distends the sphincter to such a degree as to render it probably useless. The question of whether the bladder is controlled by the internal or external sphincter remains unsolved. "My radiographs show conclusively, however, that even in the most extreme distention of the bladder the internal vesical sphincter is the seat of closure. When the marked changes in the sphincteric region with the resultant distortion are considered, it is really remarkable that the muscle retains so much of its functional activity.

function so impaired that it could not have had any effect in retaining the fluid in the bladder; this has been accomplished by the compressor urethræ muscle. In other words, the true sphincter of the bladder following suprapubic prostatectomy is situated at the membranous portion of the urethra. That this is so, I have been able to further prove by urethroscopic examinations of the posterior urethra, also by demonstrating that in these cases a catheter passed just beyond the compressor muscle completely empties the distended bladder without voluntary effort on the part of the patient. There can be no question that the compressor urethræ muscle acts as an efficient sphincter, for all of the cases in this series have excellent urinary control. That the collection of collargol found in the pouch formerly occupied by the prostate is not an overflow phenomenon caused by vesical distention is demonstrated by radiographs showing the same formation in the bladder but slightly distended. A careful examination of the radiographs reveals the fact that in some cases the two cavities are separated by a narrow isthmus. This would lead one to believe that in these instances the sphincter has either partially regenerated after the operation, or was incompletely destroyed by the operation. That the cavity left by the enucleation of the gland is not obliterated, and that the internal sphincter is not completely regenerated, is shown by the very definite radiographs after an interval of three years.

In conclusion it may be stated that

1. The internal vesical sphincter is the true sphincter of the normal bladder, and of the bladder in prostatic enlargement
2. The external vesical sphincter, "compressor urethræ," is the functioning sphincter after suprapubic prostatectomy in the large majority of cases

I desire to thank Dr Edwin Beer, Attending Surgeon to the Genito-Urinary Service of Mount Sinai Hospital, for having placed his material at my disposal, and Dr Jaches and Mr Scholtz, of the X-ray Department, for the excellent rontgenograms

Thirty-eight patients upon whom suprapubic prostatectomy had been performed were selected for this study, and in all some seventy-five radiographs were taken. The technic employed was that previously described for the normal bladder. The radiographs were taken at various intervals following operation, ranging from two months to three years. A few of the patients were radiographed several times at successive periods after operation in order to determine if time played a rôle in changing conditions observed. No appreciable differences were noted beyond the fact that an increase in the capacity was evident in the small contracted bladder after appropriate treatment had been instituted.

Concerning the contour of the bladder it was noted that its broad base so characteristic of the unoperated enlarged prostate remained practically unchanged, occasionally, however, the bladder was found on a higher level than in the unoperated case. The vault of the bladder often assumes a pear-shaped form, probably due to adhesions between the bladder and the abdominal wall. The most interesting and important changes are to be found at the outlet of the bladder.

In a small proportion of the cases only a very slight funnel formation in the region of the internal sphincter was observed, in a very few instances no changes at the outlet were to be found. It is therefore evident that in this small group of cases the internal sphincter has not been sufficiently injured by the operation to interfere with its proper function.

In the great majority of the cases (28 in a series of 38 cases) the radiographs showed two distinct cavities, a larger superior one corresponding to the bladder proper, and a smaller inferior one extending from the lower margin of the bladder and continuous with it, to the region of the compressor urethræ. The latter corresponds to the defect left by the removal of the enlarged gland. The contour of this cavity varies from a round or oval to a funnel-shaped formation. The latter is more frequent, the broad base being superior. There can be only one interpretation to these findings—the internal vesical sphincter has either been destroyed by the operation, or its

FIG 3



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EVERSION OF BLADDER.

AS A LATE SEQUEL OF MUTILATION CAUSED BY RAPE IN EARLY CHILDHOOD

BY HORACE PACKARD, M.D., F.A.C.S.,

OF BOSTON, MASS.,

Professor of Surgery, Boston University.

IN a recent hospital service a young woman twenty-one years old presented herself with the following history:

When a child of four years she was enticed away by a strange man and raped and left unconscious. She was found some hours later and taken to the nearest physician, who succeeded in checking a slow hemorrhage from a ruptured perineum and bladder. She rallied from the immediate effects of the assault and later was taken to the Memorial Hospital in Worcester where she received surgical attention, including two operations on the bladder. She suffered incontinence of urine from the time of the assault. The operations failed to relieve her. In the subsequent years she had constantly leaked urine but with the aid of a portable urinal she had successfully held her own in school life and had graduated at the High School. She had faced her infirmity with surprising patience and fortitude. What now led her to seek hospital aid was a disquieting and embarrassing physical change at the vulva which had slowly developed making it almost impossible for her to sit up or be about. On examination the condition was found which is exhibited in the accompanying color sketch (Fig. 1). There was complete procidentia uteri with also complete eversion of the bladder. There was no meatus and no trace of a sphincter. The bladder mucous membrane was in a chronic state of inflammatory infiltration, intensely red and granular. The ureteral openings were plainly demonstrable. An X-ray study showed absence of the pubic arch (see Fig. 2).

Analysis of the condition as a whole seemed to warrant the following conclusions. At the time of the assault most violent injury was done to the perineum, the anterior vaginal wall, the bladder, and the pubic arch. The pelvic floor was so mutilated that it no longer furnished support for the uterus, therefore, as the patient

developed into womanhood the uterus sank down until it occupied a position entirely outside the body. With the prolapse of the uterus the ruptured bladder had been dragged down and completely everted. This eversion was possibly more extreme and prominent because of loss of the pubic arch. The absence of the pubic arch presented a more difficult problem for solution. On exposure of this condition by the X-ray the question came up as to the possibility of a congenital defect—an exstrophy of the bladder—and an error in the story of assault, rape, etc. All questions on this point were thoroughly banished by the testimony of the physician who attended her immediately after the assault (Dr R W Swan, of Worcester, Mass.) and her own straightforward story of perfectly normal urinary function prior to the assault. It is indeed difficult even at this writing to comprehend such injury to the pubic arch as shown in the skiagraph unless infection, at the time of the assault and subsequent thereto, reached the pubic bones and a destructive osteomyelitis was the real cause of the osseous defect. What could be done surgically to relieve this distressing condition? Obviously the first thought was a plastic operation to cover the bladder defect and afford protection to the exposed mucous membrane, followed by some kind of an operation to remedy the procidentia. Careful consideration of all the attendant conditions seemed to point to the following conclusions:

- 1 Since there was no urethra, no sphincter vesicæ and no meatus urinarius remaining, any efforts to reconstruct the bladder would only result in the formation of a cloaca, lined with hopelessly diseased and infected mucous membrane which would be, throughout the rest of the patient's life, an unclean pocket and would in no wise serve as a reservoir for the urine.

- 2 Any effort to construct a continent bladder would be doomed to failure.

- 3 The everted, prolapsed, diseased bladder mucous membrane could not be advantageously utilized in any conceivable operation, therefore why save it?

- 4 Reduction of the procidentia and ventral fixation of the uterus would permanently relieve the patient from the annoyance of the protruding mass.

- 5 Removal of what remained of the bladder, transplantation of the ureters to the vaginal wall, closure of the defect left after

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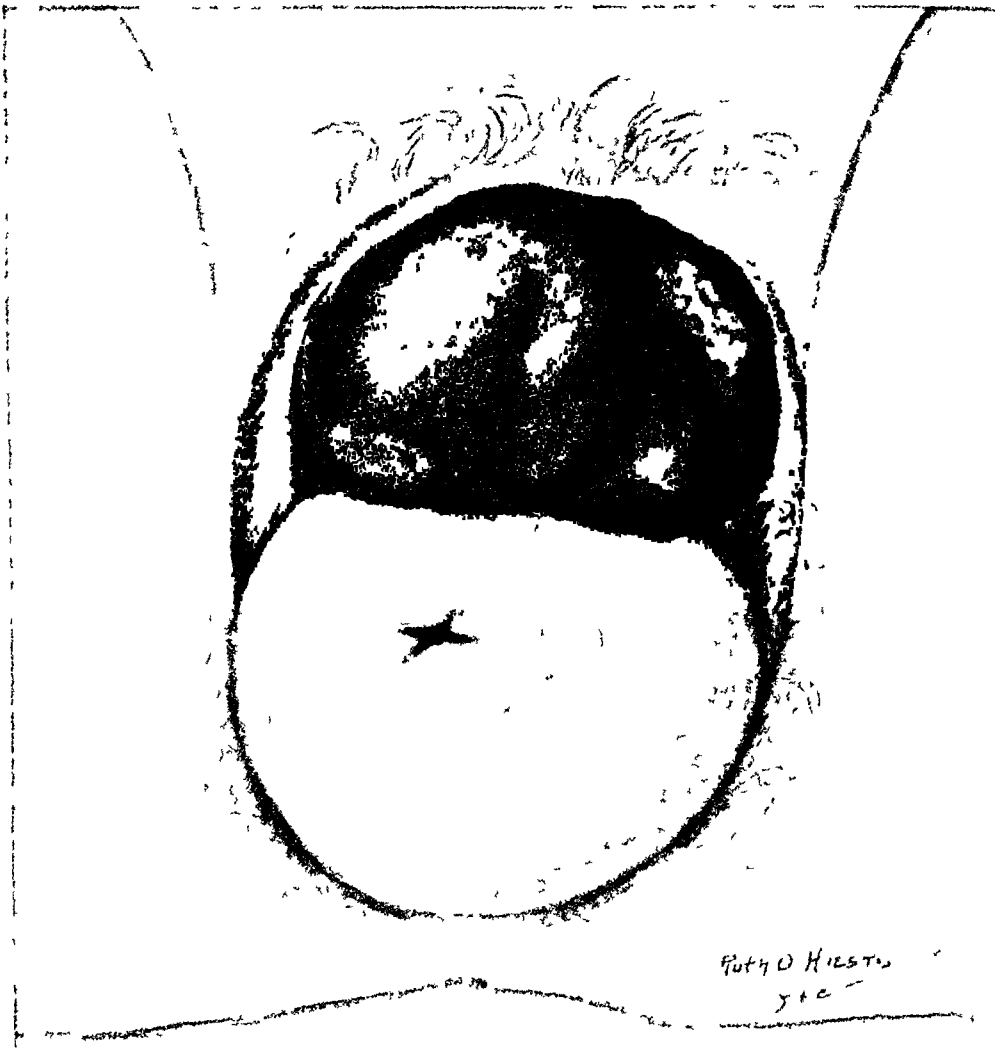
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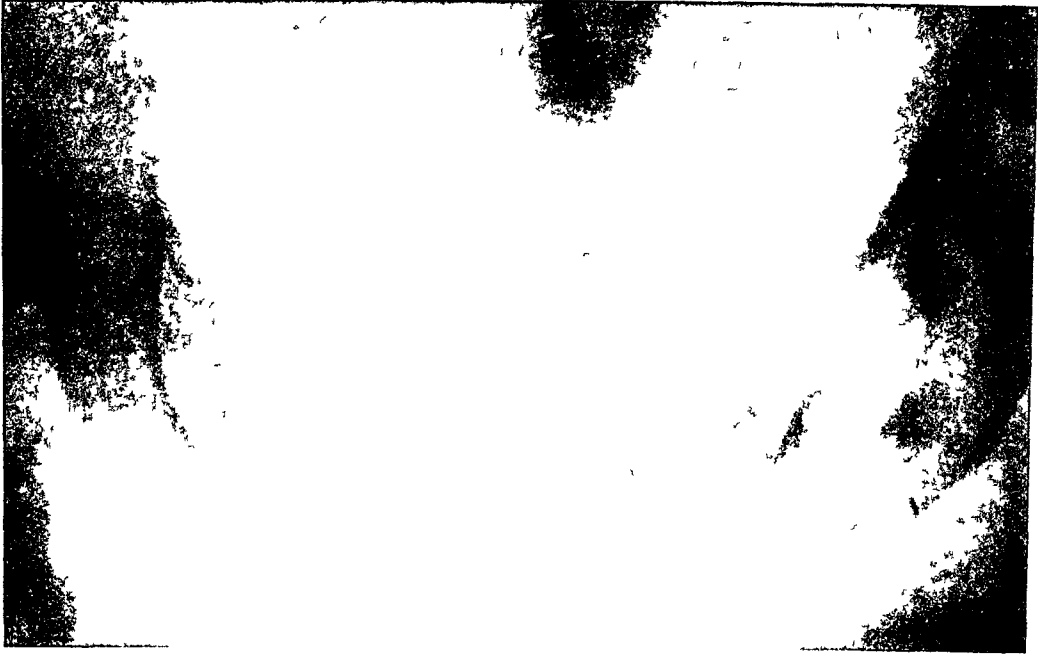
FIG 1



Procidentia and eversion of the bladder in a young woman of twenty-one years, as an indirect result of a criminal assault when she was four years old



FIG 2



Loss of the pubic arch apparently as the indirect result of a criminal assault upon a girl four years of age. Skiagraph exhibit seventeen years after.

ARTERIOVENOUS ANEURISM OF THE EXTERNAL ILIAC VESSELS, WITH WOUND OF THE EXTERNAL ILIAC VEIN.

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AND

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ARTERIOVENOUS aneurisms are not usually seen by surgeons until some months or years after their occurrence, when they come for operation, as a rule, for relief of circulatory disturbances caused by the back-flow of arterial blood through venous channels to the heart. Unable to withstand the constant arterial beating, the right chamber gradually gives way until relief is afforded by proper treatment of the aneurism. Certain local circulatory disturbances are, to be sure, always manifest in the affected extremity, but it is surprising how little real trouble is thus caused—until, perhaps, it becomes aggravated by the heart complication. This is, therefore, the real reason why arteriovenous aneurisms are seen so late in their course—the unfortunates either succumb before medical aid reaches them or, surviving the first shock, they are so slightly disturbed as to render operative interference unnecessary. Occasionally, however, the rule is broken and a case in point, most unusual and instructive, is the following.

On July 27, 1913, a little boy, L W G, aged seven, fell while playing with a pair of sharp-pointed scissors, in falling his abdomen was penetrated by the blades of the scissors, the points entering together (there was only one wound) about one inch to the inner side of the right external iliac crest and parallel to it. The boy was picked up by his mother who noticed but little blood coming out of the wound. A few hours later the family physician, Dr S H Gardner, probed the wound, but finding nothing, had the boy kept at rest in bed for further observation.

In the course of the next few days, a small pulsating swelling developed in the right iliac region in the vicinity of the wound, and coincidentally the patient showed a slight elevation of tempera-

the bladder was removed and ventral fixation of the uterus was decided upon as most likely to contribute the greatest amount of relief.

This was explained to the patient with the fact that the operation would not stop the leakage of urine, but that it would hereafter emerge by way of the vaginal canal. She eagerly accepted any plan which afforded relief from the wretched condition she was then suffering and added "that the mere leakage of urine, to which she had accustomed herself over a period of seventeen years, would be of such trifling moment in comparison with her present condition that she should consider herself fortunate in securing the relief offered by the proposed operation."

Operation was performed in accordance with the plan above outlined. The whole of the remaining bladder mucous membrane was dissected away. The ureters were transplanted to the vaginal mucous membrane and sutured in place. The defect left by removal of the bladder was closed by deep and superficial sutures. An opening was then made above the pubis and very firm ventral fixation of the uterus effected by entangling the fundus with the recti muscles and fascia.

Prompt and uncomplicated healing followed with entire relief, except the irremediable one of urinary incontinence.

ture. No complaint was made of the right leg, but the abdominal mass seemed to increase just a little each day and had almost filled the right lower quadrant by the third day when Dr Wroth was called in for consultation. A careful examination then elicited the fact that there was a visible pulsation over the mass and a definite systolic thrill present in or transmitted through it. Pulsation was barely perceptible in the femoral artery just below Poupart's ligament, but was absent below this point in the femoral, popliteal and dorsalis pedis arteries. The affected leg felt definitely cooler than the other, whose circulation was perfectly normal. There was no diminution of sensation; and motion, as far as it could be tested, was good. The boy was brought in to Washington Hospital, Hagerstown—he lived in the country—for observation and operation if necessary.

By Sunday, August 3, one week after the accident, the swelling had almost imperceptibly increased in size until it entirely filled the right lower quadrant of the abdomen and even seemed to project a little beyond the mid-line. It was so tense that we dared not attempt to elicit fluctuation, although we felt sure of the fluidity of its contents. The thrill, as noted by Dr Wroth, was still present, and seemed more easily felt than ever. Definitely systolic in character, it could be traced down the femoral artery by means of the stethoscope for about two inches where it was lost, and beyond which point pulsation could not be felt in the vessel. The condition of the leg was as first noted. The temperature was 102° but there was no abdominal distention, no pain, no signs or symptoms of peritonitis—the abdomen was perfectly soft everywhere except in the region of the swelling. In short, it seemed as if the damage was extraperitoneal and, as will be noted later, such was the case.

The tract of the wound was definitely infected and this compelled us to consider the possibility of a localized abscess having developed on top of the iliac vessels and thus giving the transmitted pulsation and thrill, or an abscess in the vicinity of an arteriovenous aneurism of the iliac vessels. After careful consideration, however, the conclusion was reached that we had to do with an arteriovenous aneurism through which a very slight, a very gradual, but a constant leakage was taking place. The boy was quite pale by this time, his pupils were dilated, his pulse was rapid, he was beginning to show signs of loss of blood. The time for operation had arrived.

confirmed my fears The third and fourth lumbar vertebræ showed involvement

In September, 1910, Mrs C, aged sixty years, was operated upon for a large scirrhous of the breast with great axillary involvement, the extent of which was not appreciated, though it was palpable, before operation, she being a very stout subject She had known of the enlargement in her breast more than two years When I expressed surprise that she had allowed it to remain so long her reply was "It does not hurt me now, I feel perfectly well and am only consenting to removal because my physician tells me that it should be done" There were no enlarged glands above the clavicle or evidence of abdominal or thoracic metastases On this account, notwithstanding its duration and the marked axillary involvement, I was disposed to advise operation and give her the chance After a most extensive operation she made a rapid recovery, going home in less than two weeks To my surprise her health remained excellent for 13 months She then began to have pain in her back and side A skiagram showed metastases to the eleventh and twelfth dorsal and second lumbar vertebræ She lived several months longer and I am informed that local recurrence was manifest at the time of her death This was to have been expected from the duration and extent of the disease at the time of operation

A fifth case, aged thirty-one, also well advanced in pregnancy, between 6 and 7 months, was operated upon in her house in this city, she declining to enter a hospital, in May, 1905 She was delivered at term of a healthy female child Three years and four months later she was delivered of a healthy male child She had seemed entirely well in every way until this last pregnancy, when a recurrence in the scar near the axilla was noticed in the last months of gestation Thirty months after the first operation she called at my office with a friend, upon whom I had also operated for cancer of the breast, and both of them appeared absolutely free from recurrence One of them is still well, more than eight years after operation I was not again consulted until a month after her last confinement, at which time there was a large mass the size of an orange, almost ready to ulcerate From the statements made by patient, trained nurse, and physician, the tumor must have grown with startling rapidity during the last month of gestation and the month of lactation Such has been the progress

a longitudinal slit about two centimetres long in the dorsal wall of the external iliac vein about one inch before it passed under Poupart's ligament. There was no corresponding wound in the artery. The ligatures were tied and the bleeding ceased.

The condition of the patient was now most critical. Pulsation at the wrist could not be obtained and respiration had all but ceased. A hurried transfusion, by means of the two-piece emergency tube² devised by one of us, was done from father to son, during the course of which closure of the abdomen was proceeded with. By the time this was completed, the patient was awake and pleading for water. He went off the table in fairly good condition. His convalescence was uninterrupted and, strange to say, at present his right leg is as good in every respect—sensation, temperature, motion, strength—as his left. Curiously, too, pulsation cannot be elicited in the femoral or popliteal arteries, yet there is pulsation in the dorsalis pedis, a strange anomaly of collateral circulation. There can be little doubt but that the interval of one week which elapsed between the time of the accident and the time of operation was of distinct benefit to the establishment of the collateral circulation, which is responsible for the good condition of the limb.

Reverting to the findings at operation, the question of their explanation naturally arises. There were certainly two separate and distinct vascular wounds (1) an arteriovenous fistula between the external iliac artery and vein and (2) a longitudinal rent in the dorsal surface of the vein separate and some distance from the fistula. It is impossible to question our diagnosis of the existence of a fistula because the thrill, the diminished pulsation in the femoral artery and the absence of pulsation in the popliteal and dorsalis pedis arteries can be explained in no other way. Nor can it be doubted that we cured this lesion in view of the fact that, although we were unable to find the actual site owing to the desperate condition of the patient, ligation proximal and distal to what we considered the site—it will be recalled that the circulation was temporarily cut off and no thrill could be felt as a guide—dissipated the cardinal signs of such a lesion, namely, the thrill and the caval pulsation. This point granted and the hole in the vein having admit-

² Bernheim, Bertram M. An Emergency Cannula, *Jour Am Med Assoc*, April 6, 1912

The patient having been prepared according to the iodine technic, a God-send in cases of this sort, tapes were passed around the femoral vessels just below Poupart's ligament in order to control any back-flow that might occur; the abdomen was opened through a generous mid-line incision and tapes were placed around the aorta and vena cava just above their bifurcation, to control any sudden hemorrhage that might occur from above. Pulsation was as strong in one vessel as in the other, confirming our diagnosis of arteriovenous aneurism.

Before proceeding further, we had Dr W D Campbell, the second assistant, compress with his two thumbs both aorta and vena cava¹ against the underlying vertebra, and ascertained that by this means practically all pulsation in the swelling could be accurately and absolutely controlled as long as the thumbs held out. Therefore, Dr Campbell having placed his thumbs in as comfortable a position as possible and all pulsation in the tumor having ceased, the peritoneal covering of the hæmatoma was incised at its most prominent point, liberating about a half liter of dark, mostly unclotted, blood which, in spite of aortic and caval compression, welled up in the cavity as fast as it could be sponged out, effectually blocking all attempts to locate visually the site of the injury to the vessels. Packing was temporarily resorted to, after which, by removing part of the gauze and having Dr Campbell ease up a bit on the aorta till pulsation could be felt, the vessels were definitely located. Ligatures of umbilical tape were passed around both artery and vein and tied, two well above and two well below what was considered the site of the fistula. Suture of the wounds was out of the question owing to the critical condition of the patient who had, by this time, lost considerable blood.

Desiring to close up as quickly as possible and congratulating ourselves upon successfully getting out of an embarrassing situation, all packing was being removed from the aneurismal cavity when to our consternation there was a gush of dark venous blood, coming apparently from the lower end of the cavity. Hurried palpation in the depths revealed a hole in a vessel large enough to accommodate the tip of the ring finger, which, acting as a plug, prevented further hemorrhage. Heavy ligatures were passed both above and below this opening, but before tying them, the vessel was brought up into view when it was seen that the wound was

¹ This seemed less dangerous than twisting or clamping the tapes, which were to be used only in the direst necessity.

PERFORATING GASTRIC AND DUODENAL ULCERS.*

WITH REPORT OF CASES

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OF BALTIMORE, MD,

Professor of Operative Surgery and Clinical Surgery in the University of Maryland

I HAVE tabulated the following list of cases for publication because it is a condition, in my opinion, more commonly overlooked in its acute stages than any other surgical malady, and for that reason it seems to me that too much cannot be said on this most important subject, and I therefore have published these cases with these few remarks.

Acute perforation of gastric or duodenal ulcers is by all odds the most serious, and, I might say the most tragic, disaster that can happen in the human body. Usually it is a sudden disaster, coming upon a patient from whom you can generally elicit a history of disturbed and imperfect digestion, with attacks at varied intervals of marked indigestion. This, at best, can be gotten, even if the ordinary typical clinical symptoms of gastric or duodenal ulcer are not elicited. These patients bear their burden, go on from week to week, and all at once, like a thief in the night, and oftentimes, according to my records, without any premonition or warning whatever they are seized with severe upper abdominal pain of a violent character, immediately followed by marked peritoneal shock. I know of no condition where the change from apparent health into a condition of great gravity is more pronounced and more marked than in these acute perforations; no disaster in surgery more imminently perilous, none so seldom recognized early; and, in consequence thereof, followed invariably by a fatal issue unless early surgical intervention is resorted to. Those operated on in the first five hours usually recover. After ten to fifteen hours the majority

* Read before the meeting of the Medical Chirurgical Faculty, April, 1912

tedly no relation to a hole similarly placed in the artery (careful though hurried search was made for this), the question may be asked, "How did these two separate and distinct wounds occur when there was only one point of entry of the implement which caused them?" The answer, in our judgment, is that the scissors were closed when they entered the abdominal cavity, but, when the handle struck the floor, the sudden jar caused the blades to open with the result that, the sweep being about parallel to the vessels, one blade passed between them, cutting a hole of equal size in their approximate surfaces and causing the fistula, while the other, sweeping downward, caused the rent in the upper surface of the vein at some distance from the primary lesion. Most of the arterial blood then, was immediately shunted over to the vein, as is usual in such cases, only to strike a set of valves a short distance beyond the fistula and be hurled back to the heart through the vein. A small volume of blood passed on down the artery to the leg and was distributed in the usual way. It returned through the usual channels until it reached the rent in the vein when it gradually leaked out of the vessel, giving rise to the hæmatoma as noted. That this formed so gradually is due in part to the diminished supply of blood going down to the leg, and in part to the probable formation from time to time of occluding clots. Had relief not been afforded, the boy would undoubtedly have bled to death within his own abdomen.

It would take us too far afield to consider the question of ligation of the external iliac vessels³ in its relation to gangrene of the leg. Suffice it to say that gangrene does occur following ligation at this point more frequently than at any other along the vessels of the leg⁴. The reason for this awaits explanation. We had every reason to expect gangrene in this case and were amazed that it did not follow.

³ Halsted, W. S. "The Effect of Ligation of the Common Iliac Artery on the Circulation and Function of the Lower Extremity" *Bull. of the Johns Hopkins Hospital*, July, 1912.

⁴ Bernheim, B. M. *Surgery of the Vascular System*. J. B. Lippincott Company, Philadelphia, 1913.

nounced peritoneal shock, with the rapid oncoming of a board-like and scaphoid abdomen, should make the observer in each case when such symptoms are pronounced, turn his attention to the region of the stomach as the cause of them, and think of a gastric or duodenal perforation as being at the bottom of this fulminating, acute, and collapsing condition, which becomes hourly more and more pronounced, until the chances of relief being offered by operation are exceptionally slight. It is certainly the one condition of all others where even a few hours of waiting costs the life of the patient.

In the slow perforations and early in the acute ones the extravasated material passes down the right side of the abdomen over the omentum, or to the outer side of the colon to the right iliac fossa, and here gives rise to tenderness and rigidity, but it is to be borne in mind that in these cases there is also associated acute tenderness and rigidity over the perforation above. The board-like and scaphoid abdomen is always present early, and not until there is a diffuse peritonitis does the abdomen become distended. With such a picture, immediate operation is called for always, and when the stomach history is elicited, as I have above stated, perforation should be suspected after the elimination, as far as possible, of other conditions.

In all of the cases I have come in contact with the pain has usually been in the epigastric region in the early stages, of a sharp, sudden, and agonizing character, and the abdominal rigidity early becomes general and board-like. The scaphoid and rigid abdomen constitutes, in my mind, one of the most marked and valuable signs of perforation, and continues until the peritonitis advances. Then the distention is noted. Distention is never noted in the early stages, and when noted, indicates a degree of peritonitis from which the patient will seldom recover.

Collapse is a variable occurrence. It takes place early, as a rule, and may be profound. Arrest of intestinal peristalsis occurs only after the peritonitis is sufficiently advanced to produce paralysis of the intestines. It is of no special diag-

in the past have died I mention this to show that in these cases we have the patient put more rapidly in a perilous condition than from any other intra-abdominal malady that I know of. The picture of peritoneal shock and rapid and oncoming collapse with a scaphoid abdomen, hard and rigid as a board all over, soon changes and the symptoms of rapid peritonitis are pretty speedily noted.

One of the first notable contributions to the subject of duodenal ulcer and its surgical treatment was the address of the President of the American Surgical Association in 1900, Dr Robert F Weir. The total number of cases then reported was small and nearly all of them were acute perforations into the free peritoneal cavity.

In most of the recorded earlier cases a correct diagnosis was not made before operation, and all the symptoms sufficiently urgent to demand immediate operation and the true condition found at operation. In many of the later cases an accurate diagnosis, fortunately, has been made before operation, due to the typical syndrome of symptoms, which, when observed, more and more certainly speak for the occurrence of this serious disaster, and in consequence of early operative interference being resorted to, many lives have been saved.

The condition is most frequently mistaken for acute appendicitis, because the pain a few hours afterward is more commonly referred to the lower abdomen. Also, it is frequently mistaken for acute hemorrhagic pancreatitis. If close attention is given to the history in each case, there will be noted prior to the oncoming of urgent symptoms the history of previous indigestion, extending in most cases over a long period, with attacks of pain in the epigastric region, with regurgitation of acid secretion, not only during the period of digestion with food, but also from a stomach empty of food, at a time when it should be free of acids. These symptoms can be usually gotten in the history before the symptoms of the attack of perforation makes itself manifest, which, when it occurs, is so markedly accompanied by such sudden, severe pain in the epigastric region, followed immediately by pro-

These patients often do not restrict their food to any great extent, and there is no appreciable loss of weight in the early stages. As the ulcer continues, however, the pain becomes more constant, the diet is often cut down, the patients are underfed, and emaciation results.

Treatment —From my limited experience I am convinced that success or failure in the treatment of perforating gastric or duodenal ulcer depends almost entirely on the time which elapses between the perforation and the operative repair.

Gibbon and Stewart report a series of twenty-two cases of perforation, and out of the twenty-two there had been ten deaths. In thirteen cases operated on within seven hours, all but one recovered, while the remaining nine, all operated on after twenty-four hours, died. These figures are striking and significant, and other operators' statistics are in accordance. This experience has been noted in my series of cases, and although one case (Case I), was not operated on for three days following the onset of his perforation, he still recovered. It is perfectly possible that an occasional case will be saved, although operated upon late. Still, the point is that usually one chance of saving life is early and complete operation. This I wish to emphasize. The importance of operating as soon as the early symptoms already enumerated have been noted. If distention is waited for, what does it mean? Late peritonitis, with very slim chances of saving life.

Since this condition is so commonly mistaken for appendicitis, the primary incision is oftentimes made in the lower abdomen, and when one recognizes the character of the fluid, a rapid elimination of the appendix and the pelvic organs should be made, and a wet gauze tuck of salt solution should be placed down in the pelvis and left for a temporary drain. The upper abdomen should be at once opened by a second incision. (I consider it very unwise to extend the incision from the lower to the upper abdomen, but make the second incision always, because of the lesser damage to the abdominal wall. Of course, the first incision is not closed, but left to drain while the work is being attended to in the upper abdomen.)

nostic aid The absence of liver dulness, associated with a scaphoid and rigid abdomen, is an invaluable sign of perforation When the distention has come on, the diminution or absence of liver dulness is of little value

Temperature in the early stages is usually normal, subnormal, or but slightly elevated Seldom is high temperature noted Pulse rate is increased, the pulse becoming very weak, thread-like, and rapid if collapse is present Usually, the respiration is entirely thoracic and shallow, and the respiration rate increased Leucocytosis is noted early, but more marked as the case advances, going as high in some of my cases as 30,000 I do not lay much stress on the dependency to be put in leucocyte count as an aid in the diagnosis in the early stages of perforation. The previous history of the patient is of great importance, and when associated with the symptoms of agonizing, stabbing pain in the epigastric region, followed by shock and collapse, attended with vomiting, subnormal temperature, rapid, thread-like pulse, accompanied with a board-like scaphoid abdomen, with or without rise of temperature, we have here a complete classic and ominous picture of a perforating peritonitis, of either duodenal or gastric origin

The symptoms in duodenal ulcer in most cases are perfectly characteristic, and admit of an unhesitating diagnosis Sometimes they exist without any symptoms until a sudden and perhaps fatal hemorrhage or perforation declares its existence The pain in a measure differs from that of stomach ulcer It is produced by the irritation of the open ulcer by the hyperacid gastric juice, and comes on after the stomach digestion is complete In other words, it is more noted just before meals (Coming on just before meals it is often called "hunger pain," and the patient usually finds that something taken will relieve the pain This is explained by the pylorus closing when there is food in the stomach and the hyperacid juice no longer gains access to the duodenum) It sometimes occurs significantly in the small hours of morning It is of a burning character, and located in the right midline, or along the costal border This colicky pain is caused by pyloric spasm

of most of the malignant tumors that I have encountered in pregnant women. In November, 1909, or forty-two months after she was operated upon she died of frightful convulsions which began a fortnight earlier. Prior to the first convulsion, and between the others, the patient suffered from severe headache and backache, due, I doubt not, to metastases to vertebræ and cranial bones, there being no other rational explanation of her symptoms. Her kidneys were sound but her liver was enormous. Drs Musser, Miller and myself were of this opinion. Autopsy was not allowed.

I have records of another case operated on early in 1904 for Dr P S Donnellan. Within eight months she began to have intercostal neuralgia and died within a year of apoplexy. She had what I have frequently called a "succulent" breast, plump, vascular, with the glandular tissue well marked and lymphatics abundant. I remember that Donnellan at the time of operation was struck with and questioned me as to the expression (succulent).

She had never borne children though married many years. Her age was forty-eight. There were probably both spinal and cranial metastases. I had never at that time employed the Rontgen rays for diagnostic purposes.

In addition to these five cases, which I saw during the final stage of their illness, I have letters from the family physicians of others which cause me to suspect that they, too, died of spinal metastases. I have records of two very interesting cases treated in Louisville, Ky, where the osseous system was involved. In one of them a spontaneous fracture of the surgical neck of the left humerus followed a large scirrhus of the left mamma which the patient concealed from me for weeks. She was never operated upon. The fracture was slow to unite, her appearance suggested cachexia, and when pressed closely, but only then, did she show me her breast. I had noticed that although an elderly married woman, her breast was always artfully concealed even when my dressings were applied. I thought I had never seen one so modest. When I saw a large mass ready to ulcerate the reason for the slow union of her fracture was apparent.

The other was a maiden lady, fifty-five years of age, the daughter of a prominent surgeon and the sister of a physician. Although she knew of a tumor in her breast for twenty years she never mentioned it to either father or brother. When she came to my office with a younger but married sister she would not allow

When the peritoneum is opened, one is usually directed immediately to the seat of the perforation by the exudate, which is, as a rule, found in the immediate neighborhood of the perforation. The method of closure must vary with the character of the ulcer, and especially with the degree of induration to the perforation. I usually close it by a mattress suture of fine silk. If the ulcer, whether gastric or duodenal, is very close to the pyloric orifice, care should be observed not to close the pylorus too tightly. I have not yet found it necessary in any of my cases to resort to a gastro-enterostomy.

Mayo reports twenty-seven patients operated upon for acute perforation. "In five, primary gastrojejunostomy was also done, with two deaths. In twenty-two, closure of the perforation alone was made, with abdominal drainage, and but one of the eighteen who recovered required a secondary gastrojejunostomy, the perforation having seemingly put an end to the disease." He believes that an excavating ulcer does not become cured unless excised, or unless nature cures it by a perforation, so that it has been found seldom necessary to do a gastro-enterostomy if the perforation can be satisfactorily closed. Where it has been satisfactorily closed, the next step in the operation is to institute proper toilet of the peritoneum, and proper drainage. As to the question of irrigation which at once arises, I personally do not make use of it. I believe that well-placed suprapubic tube drainage, with gauze protected by rubber tissue, is all that is necessary.

Suture of the perforation with pelvic drainage with the patient being subsequently placed in the exaggerated Fowler position gives the best results. The mooted question concerning whether or not a gastrojejunostomy shall be done at the same time usually is not necessary if the perforation lies, as I have just said, near the duodenum or in the pylorus, it should be sutured transversely to avoid a stricture of the lumen occurring at this point.

My chief objection to doing a gastro-enterostomy in the height of a peritonitis of this kind is the additional shock added to the patient, and from the fact that it is not usually

operation declined and he died the next morning Autopsy showed a general peritonitis, caused by a perforating duodenal ulcer.

History—In my service at St Joseph's, May 7, 1907, man aged fifty He was taken acutely ill with severe upper abdominal pain and vomiting on the fifth, two days prior to coming in This persisted, and he entered the hospital on the night of the seventh I saw him at eight o'clock, one hour after his entrance He then had a tense, rigid abdomen, leucocyte count 13,000, pulse wiry, small and extremely bad, hand and fingers cold, and his condition was most unpromising I offered operation, it was declined He grew rapidly worse and died on the morning of the 8th The belief was, and the diagnosis was so advanced, that he had a perforating gastric ulcer He had been a hard drinking man and gave suspicious history of gastric ulcer in that he had previous attacks of vomiting, the vomitus containing blood, with upper abdominal pain

NOTE (May 11)—An autopsy was gotten and a general peritonitis revealed, the cause of which was a perforating duodenal ulcer The ulcer was just distal to the pyloric orifice and the peritonitis was rather advanced, having existed since the night of May 5 From the time of the perforation to the time I saw him was forty-eight hours His condition, as I above stated, was that of a man profoundly shocked, practically in extremis Operation was declined, and he died the following morning

CASE III—Mrs L L, aged forty-five, residing in this City, operated on June 30, 1908, perforating duodenal ulcer, operation thirty-two hours after onset, recovery (Martin)

History—I was called about six o'clock on the evening of June 30, 1908, by Dr J G Wiltshire The patient's previous history showed that she had been a delicate woman and had been in the hands of many doctors, had been treated for many years for retroverted uterus, five years ago she was operated upon by a leading gynaecologist for a ventral fixation She had been more or less of an invalid ever since, not altogether laid up, but having various and sundry complaints There was no definite stomach history, no vomiting of blood, no occult blood in the stool, no special symptoms of gastric discomfort given in the history On June 29, thirty-one hours prior to my seeing her, she was seized with acute abdominal pain and vomiting This

found necessary. What is necessary is more or less prompt speedy operation, without adding undue shock to a condition which is already most precarious. The justification for this gastrojejunostomy in the majority of the cases is very questionable, and only a few cases are reported where the subsequent gastro-enterostomy has been called for. The later treatment of these cases varies a little from the ordinary case of peritonitis. The Fowler position, continuous normal salt by rectum by the drip method or the Murphy method are immediately begun, and in this way large quantities of salt solution are immediately taken up. Nothing is given by mouth for a certain number of hours, relying on the fluids taken by rectum. The question of posture is one on which the surgeons differ. I, for one, believe much good comes from the Fowler position.

The cases are presented chronologically.

BRIEF SUMMARY OF CASES.

CASE I.—Man aged thirty-eight. Entered with diagnosis of peritonitis, cause, perforating duodenal ulcer; lower abdomen opened and drained, result, died. Autopsy showed the perforation to be duodenal.

History—He was brought to my service at St Joseph's Hospital during my absence from town. He had a well advanced peritonitis, and was operated on by another operator, on account of my absence, and a lower abdominal incision only made use of. They found free pus in the abdomen and looked for the appendix and found it not at fault, and the man's condition was such that they only instituted pelvic drainage and did not open the upper abdomen for further inspection. He lived for eight or ten days, and died. An autopsy was gotten, and showed the cause of the peritonitis to be a perforating duodenal ulcer. The perforation was still open and leaking, and was located in the first portion of the duodenum. This was the first case that ever came in my service. It was some years ago, very little was known about the perforating ulcer being the cause of peritonitis, and I presume that this explains why the upper abdomen was not opened.

CASE II.—Man aged fifty; came into hospital May 7, 1907;

from the exudate holding it to the under surface of the liver, a large necrotic area was seen to extend into the liver and back toward the back. The exudate was wiped away and the perforation was seen in this area of duodenum, welling up under the liver. The man's condition was so wretched that I did not stop to suture this opening, but made a third opening in the ileocostal space in order to drain this large abscess into the subhepatic space, running down to the right side. The infection seemed to have extended into the liver, and practically giving him an abscess likewise in that region. At any rate the suppuration was so extensive and the exudate so great it was hard to say whether the abscess had extended into the liver proper or not. A large drainage tube was put from the back into this necrotic area of the liver, with iodoform tucks around it. Rubber tube drainage was also put into the upper incision, connecting with the tubes that ran in from the ileocostal space and down to the region of perforation. His condition was so extremely grave he was given salt solution while the operation was going on, and oxygen also was administered. After getting the drainage placed in the upper abdominal incision and the incision through the ileocostal space up under the liver, a tube was placed through the lower opening in the pelvis and the wounds closed around the drains. He went off the table in a condition of profound shock, and there was very little hope felt for his recovery. The suppuration was so wide-spread that it did not seem possible that he would come out of it.

Post-operative History—It was noted he showed evidence of recovery from the shock and sepsis, and drained very, very freely through the numerous drain tracts. There was a considerable amount of bile from the posterior tract, the temperature and pulse showed a tendency to approach the normal line, and after a very stormy convalescence, and replacing of drains of smaller size, the wounds ultimately closed, and but for a setback which occurred on December 18, he steadily improved. It was noted on December 18 that he complained of a sharp pain in the left side of his chest over the seventh and eighth ribs. Auscultation over this area revealed a definite friction rub. With proper treatment instituted about three days later the pain subsided and friction rub disappeared. For about five days the patient ran a normal temperature and pulse and was getting on nicely. Two

persisted all the afternoon and night of the 29th, up until the morning of the 30th. Various and sundry efforts were made to move bowels without success; numerous medicines, numbers of enemata, and even croton oil, were given. I saw her about six-thirty on the 30th; mouth temperature 100° . The picture presented was that of general peritonitis; limbs were drawn up; abdomen tense, tight, and very much distended, principal pain on palpation was over the appendix region. I expressed the opinion that she had a general peritonitis from some cause, and advised immediate operation.

Operation—She was sent at once to the Union Protestant Infirmary, and preparations were made for immediate operation. Under ether the abdomen was opened through the right rectus. As soon as the peritoneum was opened thin pus welled out from every direction. It was then noted that this pus was also markedly bile stained. I immediately sought for the appendix and found it almost entirely obliterated except about a quarter of an inch of cæcal end, no inflammation. This was eliminated as a cause. Pelvis was explored, no trouble there to account for peritonitis, nor was there any evidence of a ventral fixation having been done. Both ovaries had been removed. A gauze pack wrung out in salt solution was put in the pelvis and left. I then proceeded to open the upper abdomen, making the usual incision through the right rectus. A quantity of exudate was noted as soon as the peritoneum was opened, which extended up in the gall-bladder region and under the liver. The pylorus was seen, but nothing found to be wrong in that region, a certain amount of exudate all around the sub-hepatic area and about gall-bladder. Gall-bladder was tense, but no perforation could be seen in it. In lifting liver and pulling it out with the retractors and pushing stomach over, an opening was found in the duodenum, looking at first as though it were in the common duct. The tissues all about were necrotic, as likewise was the pancreatic tissue covered with necrotic exudate. In getting away the exudate and opening up the parts, the opening was seen, as I above said, in the duodenum, in and about the region of the common duct. Bile poured out from this opening very freely, and it was thought that the opening was in the common duct pure and simple. In fact, a small common duct stone came out with the outpour of bile. The gall-bladder was somewhat distended with

bile, and a stone felt in it. It was opened, the stone removed, and a tube introduced for drainage. Impossible to get at this opening in the duodenum to close it, a drain was left at that point, also one in the gall-bladder, iodoform rubber tissue tucks placed down into the sub-hepatic space, and the opening in the duodenum and the wound closed up around these drains. Bile poured out very freely. Then a tube was placed into the pelvis through the lower opening, several rubber tissue tucks placed around it, and the wound closed up around the drain tracts, cat-gut used, except for the skin, *no irrigation of the abdomen made use of*. She was considerably shocked when she went off the table and intracellular salt was given, 1000 c c. She was put in the Fowler position and the Murphy salt drip method by rectum was instituted.

Post-operative History—The patient's convalescence was uneventful. For a number of days there was a great outpour of bile from the drains in the upper incision, but the wounds ultimately closed and the patient made a nice convalescence. In the summer of July, 1911, she returned to the Union Protestant for the closure of a ventral hernia, which occurred at the drain tract in the lower incision. This was closed and a good recovery made. The patient is still living and in good health at the present date.

CASE IV—Mr J. P., aged fifty years, University Hospital, perforating duodenal ulcer, drainage through three incisions, operation December 2, 1908, two weeks following the first symptoms of the perforation, result, cured.

History—Patient fairly well-developed white man, fifty years of age, had been under the care of Dr. Slade, his physician, for two weeks with the history that the initial symptoms were pain, which came on suddenly in the upper abdominal region, which continued spreading to the right hepatic region and off into the right side. He suffered great pain, and had what he called "tremendous sweats," principally at night, when his clothing would be soaked. He had fever continuously, and marked tenderness in the upper abdomen. I saw him in consultation out in the country the night of the 26th and advised him to be brought into hospital immediately for operation. He had then symptoms of general peritonitis. The diagnosis was thought to be appendicitis. In palpating his abdomen I was convinced

days later he ate a piece of cocoanut cake without permission, which was followed by intense abdominal pain, chill, temperature reached 103° , pulse 140, clammy skin, and profuse perspiration. The stomach was washed out, bowels moved freely, and he got some relief. His temperature and pulse ran irregularly for about a week and then came down to normal. I attribute most of these setbacks and sudden rises in his temperature and quickening of his pulse as due to recurring leakages that took place from the still unhealed perforation. About a month following the operation the drainage tubes were all removed and the tracts granulated up. About six weeks after the operation he left the hospital *cured*. This patient was one of the illest patients I have ever seen get well.

CASE V—L. S., aged twenty, operated on at St. Joseph's Hospital for perforating duodenal ulcer June 22, 1909, twenty-three hours after the perforation, result, died.

History—This man was taken sick with violent abdominal pain on June 21, twenty-three hours prior to my seeing him, with what was supposed to be lead colic. He was seen by me late in the afternoon of June 22, when it was seen that he had general peritonitis, and his condition was rapidly growing worse every hour. Immediate operation was advised. He had a very feeble, wiry pulse, dry tongue, facial expression of a man rapidly dying from some poisoning. He was operated on shortly after his coming in, so there was no careful previous history obtained in his case. He was supposedly well, when he had this onset of severe, upper abdominal pain, which grew steadily worse in intensity and continued on with marked and progressive symptoms of collapse, showing themselves the day of his entrance. He had, when I saw him, evidence of general peritonitis, tense, tight abdomen, and beginning distention, so he was taken at once to the operating room.

Operation—Lower abdomen opened; the peritoneum and cellular tissue just under muscle and between muscle and peritoneum were filled with jelly-like exudate, and as soon as the peritoneum was opened a quantity of yellowish, straw-colored fluid welled out. Fresh exudate was seen all over the intestines, in other words, there was a diffuse general peritonitis. This sero-purulent fluid welled out in great quantities from all sections of the abdomen. It was likewise bile tinged. The appendix was

that he had definite suppuration in the upper abdomen as well as the lower abdomen, and expressed the opinion that I did not think appendicitis was the cause, but more than likely that it was due to a perforating gastric or duodenal ulcer. The abdomen was markedly distended and tender universally on pressure, particularly in the right side and above the umbilicus. He was not entered into the University Hospital until mid-day of December 1. When I saw him he presented such a haggard facial expression and was so completely "all in," as it were, that I thought it unsafe to attempt any operative procedure that day, as I did not believe he would live through it. His rectal temperature was 104° , leucocyte count 33,000, pulse 130. He was put in the upright sitting posture and salt solution given both intracellularly and by rectum. The following day, December 2, I decided to operate. He was practically no better. His leucocyte count was 35,000, pulse very quick and of no volume, rectal temperature subnormal; he looked badly, had a bluish, cyanotic tinge of skin, and presented a picture of rapid going down from abdominal suppuration.

Operation—This was performed in the early morning of December 2. The abdomen was opened by an incision in the lower abdomen, a quantity of pus and yellowish fluid escaped, with some gas. The whole abdomen was in an advanced stage of general peritonitis, pelvis full of pus, and lots of exudate between layers of coils of intestines. On passing a hand down into the pelvis a lot of white, flaky pus welled out. Around the cæcum there was a lot of fresh exudate and a regular layer of exudate one-sixteenth of an inch thick. The appendix was covered over with this exudate. It was rapidly taken off, but there was no evidence of perforation in it, and it was eliminated as the cause of the peritonitis. A large gauze tuck wrung out in salt solution was placed in the pelvis and a second incision was made in the upper abdomen through the right rectus and as soon as the peritoneum was opened a huge abscess was gotten into, consisting of the same flaky pus. A quantity of exudate was all around in this region, around the liver and stomach and duodenum. There was no perforation in gall-bladder, but the exudate extended to the under surface of the liver and around the gall-bladder, and in this region a great quantity of pus welled up from the back. In separating the duodenum

sought for and seemed to be normal, covered with exudate, as likewise were the intestines all about. A hand was passed into the pelvis and a quart or more of this fluid welled out. A good deal was mopped out and then a gauze pack wrung out in normal salt solution placed in the pelvis for drainage. The second opening was made in the upper abdomen through the right rectus, toward the midline, and before the peritoneum was opened this same jelly-like condition in the tissues prior to reaching the peritoneum, as was noted in the lower abdomen, was also noted here. When the peritoneum was opened a great quantity of sero-purulent fluid welled out in great abundance, with free exudate all over the stomach and omentum and adjacent structures. As the stomach was pulled toward the left side I saw a perforation in the duodenum. It was punched out like a bullet hole, about the size of a little finger, situated about one and a half inches below the pyloric orifice, and this quantity of fluid was pouring out. His condition was that of profound shock, with scarcely perceptible pulse. He was taking the anæsthetic badly, and became rapidly more shocked. The perforation was sewed up with several mattress sutures, which closed it completely, and a Lembert suture put in over this. No irrigation was used in the peritoneum. Drains were then placed and the abdomen closed up around the drain tracts, both in the upper and lower abdomen. The patient did not respond to any quantity of salt solution that was given him, but rapidly sank into more profound shock, and died from the peritonitis some ten hours following the operation.

CASE VI—Mrs M. E., Amboy, W. Va., aged forty-three years, University Hospital, gastric ulcer, anterior wall, complicated with cholelithiasis and pericholecystitis, operation October 21, 1909. Result, cured. The ulcer had perforated, but was sealed off in the exudate forming adhesions around it. The perforation was opened up at the time of operation, showing a well-defined gastric ulcer. Part of the ulcer was dissected out, and the opening closed. This case is of interest as occurring combinedly with gall-stone disease, having possibly at some side of history perforated, but was blocked and closed by exudate thrown over this a inflammation occurring about and around the point of treatment instead.

A brief history of the case is as follows:
 A normal temperature recorded by Dr James R. Cole. Eighteen years ago she began to have attacks of trouble with pain referable to the gall-bladder, and on since then she has had attacks

days later he ate a piece of cocoanut cake without permission, which was followed by intense abdominal pain, chill, temperature reached 103° , pulse 140, clammy skin, and profuse perspiration. The stomach was washed out, bowels moved freely, and he got some relief. His temperature and pulse ran irregularly for about a week and then came down to normal. I attribute most of these setbacks and sudden rises in his temperature and quickening of his pulse as due to recurring leakages that took place from the still unhealed perforation. About a month following the operation the drainage tubes were all removed and the tracts granulated up. About six weeks after the operation he left the hospital *cured*. This patient was one of the illest patients I have ever seen get well.

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of pain in upper abdomen, etc Last summer she had jaundice which lasted three months She said she thought she had had no indigestion except when she had these attacks when there was a certain amount of gas distention, had lost some weight I advised operation

Operation—Under ether I made my usual incision in upper abdomen to right of midline and came down to the edge of the liver and found a mass at the border of the liver, adherent to free border of liver, and pyloric end of stomach was intimately tied up in this mass, and the pyloric arm of the stomach was adherent to gall-bladder, and was tightly tied down by old adhesions In packing off the subhepatic space and getting the liver up, the free border of the liver showed a cicatrix and this mass was adherent all along free border In beginning dissection to free adhesions, I first tried to free stomach and in doing so the stomach wall gave way and some contents of the stomach came out After getting it freed, I found the cause of this giving way was an ulcer which had become adherent to the free border of the liver and fundus of gall-bladder; after getting it freed, I sutured up this opening in stomach, inverted quite a little section so as to turn in opening, and closed it This was about one and one-half or two inches probably from the pyloric orifice in the pyloric arm of the stomach, on the anterior wall of the stomach down toward the greater curvature I wish to emphasize right here that this giving way was due to an old ulcer of the stomach, which had caused the dense adhesions to the gall-bladder I then went on with the operation and did my usual cholecystectomy She stood the operation well

Post-operative History—She made an uninterrupted recovery, and the last report was that she was thoroughly and entirely well, and had no disturbances whatever.

CASE VII—Mr O F, aged forty-four years, St Joseph's Hospital, operation March 6, 1911, three or four days following the first symptoms Result, died This was a gastric ulcer with acute perforating peritonitis He came in practically in a hopeless condition Diagnosis was made briefly before the operation, and operative procedure was resorted to, but the operation was too long delayed and the patient was too badly poisoned and shocked to recover, and died some hours afterward He was referred by Dr. Duncan.

History—He was brought into St. Joseph's Hospital in a

her to enter my consulting room. She explained to me that she had kept it a secret from her family and friends and had only been made to seek advice on account of the very rapid growth of the mass during the previous few months. It was not painful. Sarcomatous degeneration of a benign tumor seemed clear. After much insistence she accepted operation. It proved to be sarcoma. In six months she began to complain of rheumatism in her right hip. In time a tumor of the femur, showing in Scarpa's triangle, developed and before her death attained large size. There was never local recurrence. I was absent from Louisville when she died and no autopsy was made.

I have reported these cases and could cite others to show how frequently, and how early metastases to the osseous system may take place. So unhappy has been my experience of them that when one of my operative cases, which I had considered relatively safe, begins to complain of intercostal neuralgia, backache, or rheumatic pains uninfluenced by antirheumatic treatment, I am disposed to throw up my hands and await the inevitable.

I expressed this opinion to the late Maurice H. Richardson, who was at the clinic above referred to and who spent four hours with me examining all the patients, gross specimens and microscopical slides. He agreed with me that the bones were more frequently involved than is generally believed and said that his experience had been much as my own. America has produced few surgeons with so wide an experience, who observed and thought so accurately and who always reported his convictions so conscientiously. One always felt after Richardson had spoken on a subject that the last word had been said.

But unexpected manifestations, such as above detailed, in a disease so protean in its nature as cancer, while discouraging, should also emphasize the necessity for earlier operation. There was a time when every one of the cases I have referred to could have been saved. A time when the original focus in the breast was inconceivably small, a diseased cell, a germ something, we know not exactly what, but we do know that

to pick up and improve, but his pulse lagged and after a certain time he commenced to go down and died the following day

CASE VIII—Mr W S, aged thirty years; St Joseph's Hospital, stomach ulcer, operation July 6, 1911, at least twenty-four hours after first symptoms of perforation I saw him in the Dispensary at St Joseph's Hospital He had a board-like abdomen, and evidence of distinct peritonitis, with great pain in the epigastric region, and in fact it had extended into the lower abdomen likewise The perforation existed twenty-four hours before, according to the history it occurred acutely and suddenly, with severe onset of symptoms Result, died

History—Has had diseases incident to children, had pneumonia at age of seven years, has not had typhoid, has had influenza a number of times, has also been troubled with indigestion for fully five years past, and at times would become nauseated and vomit Two days before his present condition came on he was riding along on the car and became sick, even before he got home he began to have sharp pains in his epigastrium Habits are good, never drank to excess, but takes a drink occasionally, negative to venereal disease He entered the hospital on July 5, 1911, complaining of intense pains in his abdomen with nausea and vomiting The day before, July 4, he was taken with these pains, which recurred both in frequency and intensity until he came into the hospital His facial expression was that of intense pain Upon palpating his abdomen pain, tenderness, and muscular spasm were marked Bowels were constipated, appetite lost, urine scanty, high colored with no cysts or albumen Slight cough, with little expectoration, no spitting of blood No swelling of his feet Patient was operated upon July 6, and there was found a perforated stomach ulcer with a consequent general peritonitis

Operation—He was operated on certainly twenty-four hours afterward, and this stomach ulcer was found, and a diffuse peritonitis existing He was treated by an opening in the lower abdomen, and things excluded there, and found to be in the upper abdomen As I had previously stated, I thought it was a gastric perforation, still I opened in the lower abdomen to exclude any possibility of a perforated appendix as a cause of peritonitis Then I opened the upper abdomen and found the perforation in the stomach with a great deal of leakage occurring.

practically dying condition, with diagnosis of appendicitis. When I saw Dr Duncan he told me he thought the man had gone down unusually fast. When I saw the man I found him practically pulseless and looked him over and in view of the history gotten, the rapid going down of the patient, with the early symptoms being located in the upper abdomen, I expressed the opinion that the man did not have appendicitis, but a perforated stomach ulcer and that I thought the chances of doing him any good very slim, because the perforation had gone too far and his condition of collapse was too great. I advised operation, however, and operated about seven o'clock that night. The history given me is as follows. He had been complaining of pain in the stomach and vomiting for three or four days and had been using a mustard plaster immediately over stomach, and this pain continued until he had *bad pain*, and Sunday afternoon, March 5, he was seen by Dr Duncan and things were given for relief of pain, and the doctor, thinking it was probably appendicitis, decided not to act and waited until the next day, when he found the patient desperately ill, he had gone all to pieces. He did not bring him into the hospital until late that afternoon, and I saw him shortly after his arrival. I could make out no marked rigidity about appendix region, and with this history of long-standing trouble in upper abdomen I gave my diagnosis immediately as perforated stomach ulcer. I opened him through right rectus and found the abdomen full of a great pour-out of stuff from upper abdomen, and marked peritonitis. I ran my hand down into the pelvis, and pus just welled out from pelvis by the pints—just gushed out, gauze packing was put down in pelvis and then I opened upper abdomen and there was also evidence of peritonitis, and on pulling stomach forward I broke up adhesions that were around the pylorus and as I rolled out pylorus there was a huge hole in pyloric arm of stomach which was so callous and hard it presented the appearance of carcinoma. I take it that it was an old stomach ulcer which had been shut in, and these adhesions had given way and peritonitis had been the result. His peritoneum was overwhelmed with stomach contents, etc., and an advanced peritonitis existed all through the abdomen. He was practically dying, I closed the hole as best I could with mattress sutures and left in drain above and below. He was infused and sent back to the ward, and after a while he seemed

and on opening the abdomen I made my incision in the upper abdomen because it simulated possible gall-stone trouble, and as I had seen several cases where the symptoms were similar, namely, those of apparent obstruction due to some infection about the gall-bladder, I made my incision over the gall-bladder region. In going over the intestines I found no definite evidences of obstruction, intestines were ballooned, but there was no trouble there. I found a cholecystitis, and did a cholecystotomy. The patient had rather a stormy convalescence. The drainage in his gall-bladder was left in, I take it, unnecessarily long, and finally closed. Some infection of his wound took place, and it gaped in the upper portion. The wound closed finally, and he went out. After some weeks he returned to the hospital with a discharging sinus at the old drain tract, and it was rather a foul smelling discharge, and apparently it was coming either from the stomach or duodenum. This discharge grew less after treatment and quiet, and gradually closed. Just what happened I was unable to say, except I thought possibly an ulcer of the stomach may have perforated into the drain tract, and so waited on him.

Operation—In the middle of April his wound was about closed, and I opened down with a view of closing this ventral hernia, which was of a fair size. In dissecting up the adhesions I found an evidence of an old duodenal ulcer, which explained the above mentioned condition. This was such that I could turn it in. The infiltration was not extensive, so I made use of that procedure as a means of correcting the trouble rather than doing a resection. I turned it in, sutured the serous surfaces well over it, and closed his ventral hernia. He made an uninterrupted recovery.

CASE XI—Mr J K, British seaman, aged thirty-eight years, University Hospital, perforating gastric ulcer; operation May 3, 1912, admitted to hospital April 8, 1912, complained of pain and discomfort in stomach for a year prior to operation.

History—The brief statement that I heard in regard to him was that he was under care in hospital for stomach ulcer. On the morning of the third of May, my assistant informed me that there was a case they thought was perforated gastric ulcer. It had just been turned over to us about fifteen minutes before. The patient was in hospital in the medical services and on the night of the second of May he had bad upper abdominal pain.

The perforation was closed, drainage instituted both in the lower and upper abdomen

Post-operative History—For the first few days he bid fair to do well, up to forty-eight hours, and then his peritonitis flared up again and that continued to grow worse, causing his death, three days after operation

CASE IX—Mr B, aged sixty-six years, Hebrew Hospital, acute perforating duodenal ulcer, consultation May 18, 1911 Result, died

History—I saw him in consultation with Dr Bagley, May 18, 1911, for acute inflammation of the abdomen, which had existed since the 16th The whole history was that of a stomach or duodenal perforation with sudden onset and violent epigastric pain, rapid oncoming of shock, and a board-like abdomen existing at the beginning of the attack, followed by a distended abdomen, and when I saw him he was in a condition of full-blown peritonitis, with distention and pain, vomiting, no movements of the bowels, and there was some question as to whether he had an obstruction or whether it was an acute inflammatory condition The whole history was one pointing definitely to a perforation of a duodenal or gastric ulcer, and I so expressed my opinion that I thought it was one or the other, and that the case was most unpromising, in fact, that the perforation, or whatever the cause of the trouble was, had existed since the 16th, and operative interference seemed unpromising It was advocated, however, hoping it might be of some avail

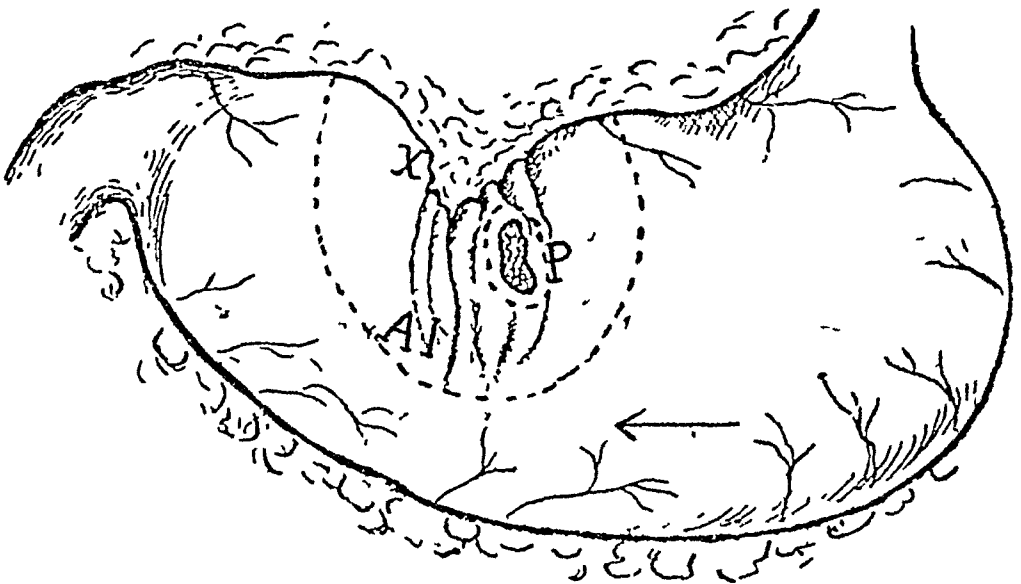
Operation—He was taken into the Hebrew Hospital and operated on by Dr Bagley The findings at operation disclosed a perforating duodenal ulcer, and death resulted This was a hopeless case from the fact that the time existing between the operation and the occurrence of the perforation was over forty-eight hours, and the perforation was so far advanced that death was practically inevitable

CASE X—Mr X, aged forty-nine years, St Joseph's Hospital, operation April, 1911, result, cured Duodenal ulcer perforating into the drain tract following an operation done for the drainage of his gall-bladder, or cholecystitis

History—He entered St Joseph's Hospital during January, 1912, with symptoms of intestinal obstruction, was turned over to me with a case possibly of obstruction, considerable vomiting,

into the surrounding tissues. It was held down in this position out to this marked infiltration and induration. This had produced a regular hour-glass contraction of the stomach (Fig 1). All within the dotted line shows dense infiltration into the ulcer-bearing area to the greater curvature, leaving only a small way out for the cardiac pocket of stomach to the pyloric pocket of stomach, as shown by arrow. The perforation was at the point indicated by *P*, near the cardiac side of the ulcer and this material was just welling its way out from this perforation. It was

FIG 1



AI, area of infiltration, *P*, perforation, *X*, saddle ulcer with contraction. It was a saddle ulcer on a carcinomatous base with marked carcinomatous infiltration. This is the first carcinoma of the stomach that I have had in my experience in which there was a perforation. All within the dotted line shows dense infiltration into the ulcer-bearing area to the greater curvature, leaving only a small way out from the cardiac pocket of stomach to the pyloric pocket of stomach, as shown by arrow.

just a small opening, but on examining it the walls were distinctly infiltrated, so I concluded to cut it out, excise the perforation, for several reasons. First, to get a good view of the ulcer, where it had extended through the different walls of the stomach, and finally through the peritoneum, showing this cone-shaped extension of it, and also in order to get sufficient material for microscopic examination, and third, because I fancied I was able to close the opening better than if I attempted to close and invert this opening by purse-string suture or whatnot. So with a knife I simply went around it as is indicated by the dotted line around the opening at *P*. Of course, the incision extended through the heart of the ulcer tissue. The dotted line at *P* indicates the

and a rise of temperature, the chart showing that it had been running normal, and a rapid coming on of marked collapse, with, I presume, a stiffening of the abdomen. The patient grew rapidly worse, but my assistant's attention was not called to him until just prior to my entering the hospital, which was about ten o'clock. I saw him at once, and felt his pulse, which was very shocked, very wiry, and very rapid, and saw the facial expression of collapse and a distended abdomen. I did not stop to investigate further, but ordered him into the operating room, gave my opinion that with his history and the symptoms present, he had unquestionably duodenal or stomach ulcer perforation. He was taken at once to the operating room with a diagnosis made. His condition was bad. It had been a number of hours since this had happened, about fifteen or sixteen.

Operation—I opened first his lower abdomen and a great quantity of gas bubbled out, and a great quantity of dirty looking and purulent material. I passed my hand down into the pelvis and this creamy looking substance came out of him in great abundance, a quart or more rolled out. I then did not stop to investigate the organs in the lower abdomen, but with this escape of gas and this great quantity of fluid and matter, I put a large salt tuck into his abdomen to let a certain amount of this be absorbed, and then immediately opened his upper abdomen. As soon as the peritoneum was opened gas escaped from there and a quantity of this same material was noted, and a lot of exudate was seen filling the upper abdomen. The material seemed to be welling out from an opening somewhere in the region of the stomach or duodenum, and, as I expected, the adhesions grew more and more as I worked my way up under the liver. The tissues there were covered with a dense layer of exudate, the material seemed to drain out all the way down. Under the liver there was a great quantity of exudate, and as I pulled the stomach forward I thought at first I saw the perforation in and about the neighborhood of the pylorus, but on getting things better opened up and tucked off, I found this to be a mistake, but that the perforation was right to the cardiac side of a big saddle ulcer, which extended down from the lesser curvature toward the greater curvature on both the anterior and posterior walls of the stomach, more or less fixing the stomach because of the dense infiltration extending out from this saddle-like ulcer.

of perforation; necrosis of the bottom of the ulcer had gone through to the peritoneal coat and it was just ready to perforate. She made an uninterrupted recovery and has been entirely relieved. The last report from her was she was entirely well, able to eat all kinds of food, and enjoyed splendid health, and had an absence of her pain, which brought her to me for operation.

CASE XIV—Mr W I, aged thirty-two; referred by Dr B B Brown, operated on March 12, 1913, gastric ulcer.

History—For three or four years he had pain in the epigastric region, and he was brought to me by Dr B B. Brown. I operated, and here, likewise, the ulcer had gone deeply and was nearly ready to give way. A pylorotomy was done, followed by a gastro-enterostomy, with a very happy result.

CASE XV—Mr H H, aged twenty-seven; referred by Dr A H Carroll, operated on June 11, 1913, duodenal ulcer.

History—He was brought to me with a duodenal ulcer. A pylorotomy was done, followed by a gastro-enterostomy. He made a good recovery.

NOTE—Cases XII, XIII and XV in this series are cases that were found at the time of operation to be typical duodenal ulcers just on the verge of perforation, and Case XIV was a gastric ulcer on the verge of perforation, and should by rights be classified as perforating cases, because the serous coat had not given way but the necrosis in all of the cases had practically gotten through the peritoneal coat. They were operated upon and in all of the cases a pylorotomy was done, the entire ulcer-bearing area removed, the gastric and duodenal section ends were closed by my special method of closure, and a posterior gastro-enterostomy done, and all of the cases made uninterrupted recoveries. Photographs of the ulcers and full record of the cases are published in an article by me in the *Transactions of the Southern Surgical and Gynecological Association*, volume xxv, "Gastric and Duodenal Ulcers, with Special Reference to the Method of Operative Procedure Employed."

Cases XIV and XV are recent pylorotomy cases which have not as yet been reported, and simply add to this list of ulcers which have been dealt with according to my judgment in the most radical and proper way to combat such cases; namely, by pylorotomy and posterior gastro-enterostomy.

line of incision around this perforation This was taken out and then mattress sutures were put in, closing it Several tucks were put up around the lesser curvature, where this exudate was, and over the sutured area, so if leakage occurred it would have a way out Then rubber tissue tucks and a rubber drainage tube were passed into the pelvis and the wounds closed up around the drainage The man had salt solution during the operation, and went off the table pretty badly shocked during the operation, but still holding his own He soon reacted, made an uninterrupted recovery, and lived for a number of months The microscopic examination of the section that I removed showed the infiltration around the ulcer was carcinoma This had infiltrated all through to the back It was impossible to do a resection of the stomach, so it was left as found, the ulcer simply being closed The man recovered from this perforation, gained flesh, and lived a number of months, and finally died of the further advance of his cancer By the way, it is the first carcinoma of the stomach that I have ever seen in which there was a perforation

CASE XII—Mr J K, aged forty-four, referred by Dr A H Carroll, operated on June 28, 1912, duodenal ulcer

History—The findings in the case were ulcer, located on the duodenal side of the pylorus, and actually was a duodenal ulcer, and the ulcer was so thin that it was on the verge of perforating, and a radical pylorotomy, followed by a gastro-enterostomy, was done The patient made an uninterrupted recovery and has been restored to perfect health

CASE XIII—Mrs T P, aged thirty-two, referred by Drs Oscar B Beer and J M King, operated on October 12, 1912, duodenal ulcer

History—She came in with a history of longstanding upper abdominal pain and indigestion, and it was thought possible in this case that the case was one of gall-stones At operation it was found to be a duodenal ulcer, situated about $\frac{3}{4}$ of an inch from the pylorus, that is, on the duodenal side of the pylorus, and on the anterior wall of this portion of the duodenum, the most common site of the ulcers in this area A radical extensive pylorotomy was done and my method of closure resorted to, and a posterior gastro-enterostomy was done In this case the ulcer was likewise just on the verge

for a time it is strictly local. It may remain so for weeks, months or years, varying with the organ affected, the abundance of its lymphatic supply and possibly other influences of which we know little. The evidence that carcinoma is at first strictly local is so complete and overwhelming as to leave no possibility for doubt, if one carefully considers it and is uninfluenced by the masters of a former generation, who were as slow to acknowledge and put into practice the discovery of Moore as they were to accept the inestimable blessing offered to them by Lister.

If the disease were constitutional one could never hope to effect a cure by local measures, and so long as they were practised in a partial, incomplete, and faint-hearted manner upon unfavorable cases a cure practically never resulted. But when operative limits were extended even unfavorable cases were sometimes, but rarely, cured. More extensive procedures upon average cases brought a still greater measure of success, and now, free removal of early lesions is generally followed by a permanent cure. Operations for mammary cancer yield 80 per cent of cures if practised before the disease has spread to the nearest lymph-nodes, and a larger per cent of early, strictly local carcinomata of the lip and larynx yield to excision. According to Judd, 93 per cent of the traced cases of epithelioma of the lip at the Mayo clinic were permanently cured. Sir Felix Simon reports 85 per cent of cures in local laryngeal growths.

But, unfortunately, there is no way by which a clinical diagnosis of cancer can be made with certainty even after it has ceased to be strictly local, much less can it be done beforehand. Taking all cases as they present themselves to us at the present time—early or local ones, fairly early or those with moderate involvement of the nearest chain of nodes, and unfavorable or late ones, in other words, where there is greater infiltration of the tissues around the original focus and more extensive glandular infection, but still safely removable by the knife—we must be content with a number of five-year cures ranging from 10 to 50 per cent and upward, varying with

ANALYSIS OF CASES OPERATED UPON

My record shows 15 cases. There were 11 perforations and 4 on the verge of perforation, for which pylorectomies were done just before perforation occurred. To emphasize what I said about the frequency of duodenal ulcer, it shows a greater number of duodenal than stomach. In this list there are 10 duodenal and only 5 stomach perforations. 12 of them came to operation in my service. Of the other 3, one was operated on by another operator in my services and simply a lower abdominal incision made, with drainage, but with a fatal outcome. One other I saw and advised operation, but it was declined. The patient was practically all in at the time, but an autopsy was gotten, and the ulcer located in the first inch and a half of the duodenum was found, verifying the diagnosis. The other, I saw in consultation with another surgeon, the patient was in extremis, all in. He was sent at once to the hospital and operated upon, but with a fatal issue.

The cases that recovered, except one, bear out the important fact that if aid is gotten promptly and early, the chances of recovery are that much greater. In all of the ones that were lost in my hands, they were operated on over twenty-four hours after the beginning of the perforation.

There was one of my series, the most interesting case, that came to operation several days following the perforation. I take it that he must have had slow perforation, with final overwhelming leakage, which put him in almost an extreme condition. He was so ill when he came into hospital that I hesitated whether to undertake it. He had well marked peritonitis, and several openings were made in the abdomen, and one in the flank, giving him pretty free drainage, as there was a large collection up under the liver and lesser omental cavity. His condition was such that it was thought highly probable that he would not live to get off the table, but after quite a stormy period of illness he made a very excellent recovery.

The ages in these cases varied from twenty-one up to fifty or thereabouts.

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PERITONEAL AND PLEURAL ABSORPTION, WITH REFERENCE TO POSTURAL TREATMENT.

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AND

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PRACTICALLY every peritoneal surface has been utilized and every possible position assumed in postural methods of treating acute peritonitis. Though of recent origin this form of treatment has been almost universally accepted and is considered subordinate only to drainage in importance.

The basis for postural methods, as originally instituted, was v Recklinghausen's claims (1863) of open channels or stomata, which established direct communication between the peritoneal cavity and the lymphatic system and thus afforded a ready explanation for rapid absorption of peritoneal fluids. These stomata, however, were thought to be almost exclusively limited to the central tendon of the diaphragm, and for this reason peritoneal absorption was considered restricted to this region. Though immediately accepted, v Recklinghausen's claims were soon disputed. His observations were never substantiated and finally through the work of Kallosow (1893), Muscatello (1895), and MacCallum (1903), the stomata have been definitely proven to be artefacts; but Muscatello still maintained that the central tendon of the diaphragm was the exclusive absorbing area of the peritoneal cavity and that an intraperitoneal current carried the peritoneal fluid to this region. Although the peritoneum has since been considered a completely closed cavity, medical literature is still replete with theories and arguments based on the supposed presence of stomata.

The practical import of these claims was first evidenced by

the proposal of Clark's¹ position (1897) Although Clark recognized the fallacy of the stomata, he based his position upon Muscatello's claims of almost exclusive diaphragmatic absorption and reasoned that by elevating the foot of the bed 20°, gravity would so hasten the normal current to the diaphragm and increase absorption that it would constitute an effectual prophylactic method against an ensuing post-operative peritonitis He thus felt secure in discarding the customary drainage Any claims of efficiency from this position were overbalanced by the general dread of ensuing toxæmia from the rapid absorption through the supposedly sieve-like diaphragm

As an expression of this opinion, Fowler (1900) advocated the exact reverse or sitting posture for the treatment of this disease Fowler hoped to retard the current to the diaphragm where absorption was thought to be very high and to collect the peritoneal exudates in the pelvis, where absorption was considered minimal

As evidenced from his original publication Fowler's position is based upon a full assumption of the then disproven claims of v Recklinghausen That Fowler was aware of the evidence against the existence of stomata is attested by his "full knowledge of the alleged anatomical and physiological reasons" advanced by Clark in his review of the literature Moreover, as will be shown subsequently, peritoneal absorption is almost entirely by the blood and not by the lymph as assumed by Fowler The whole foundation for Fowler's position has consequently been disproven

Deprived of its scientific basis, this position becomes a purely empirical measure, its reputation and validity resting on clinical statistics alone The inadequacy of clinical statistics is demonstrated by the manifested skepticism, which is similarly based upon statistics both with and without this position The complexity of the conditions with so many factors inseparably involved, the great variation in the severity of the cases treated, the difficulty of classifying cases according to the loca-

¹ We are informed from a personal communication that this postural method has been discontinued by Dr Clark himself

tion and extent of the peritonitis, the virulence and character of the infecting organism, the individual resistance of the patient, the variety of treatments synchronously employed, necessarily subordinates the value of clinical statistics. Fowler's position, therefore, must by some chance acquire more logical reasons for its success than those given at its inception, more definite scientific proof of its value, or, failing in this, ultimately lose its place in the treatment of peritonitis.

The basis for Clark's and Fowler's positions may be regarded as *physiological*, *i e.*, the supposed difference in the power of absorption of different parts of the peritoneal serosa, principally the diaphragmatic. The basis for a later addition to postural methods may be regarded as *mechanical*, *i e.*, the principles are gravity and the mechanics of abdominal drainage, absorption playing a minor or negligible rôle. In this group may be placed the postural methods of Coffey and Kuster.

Owing to the difficulty of gravitation of fluids into the pelvis Coffey places the patient in the lateral or a combined lateral and head elevated position in order to collect and drain pus from the flank.

Kuster utilizes the ventral position. Though he apparently utilizes capillary drainage he thinks drainage is greatest where the patient is so placed that the incision is at the most dependent point.

This paper² is intended as a résumé of an experimental study, in which an attempt is made to establish the scientific value of postural methods of treatment. For the opportunities of this study it is a pleasure to express our gratitude to Professors Halsted and Abel.

We have attempted to determine (1) whether the dread of infected material reaching the diaphragm is justified, (2) the manner and channels of absorption from the peritoneal and pleural cavities; (3) the rapidity and relative amount of absorption from these cavities in various postures, (4) the distribution of fluids as determined by gravity.

² The amplified form of this communication will appear in the "*Beitrag zur klinischen Chirurgie*."

Method of Absorption of Fluids from the Peritoneal and Pleural Cavities—Until recently the peritoneal and pleural cavities have been regarded as integral parts of the lymphatic system, though the manner of absorption of the contained fluid was not clear v Recklinghausen (1863) first claimed open communication through stomata as mentioned above Almost synchronous with the refutation of the existence of these stomata, doubt was thrown upon the lymphatics as absorbents of these fluids Starling and Tubby (1894), Heidenham (1896), and Hamburger (1895), working independently and along different lines, concluded that absorption was into the blood and not into the lymphatics Starling and Tubby injected indigocarmine and methylene blue into the peritoneal cavity and found these colors in the urine long before they appeared in the lymph dripping from the thoracic duct Later the colors were detected in the blood before the lymph Heidenham was unable to find any augmentation in the lymph flow following injections of large quantities of fluids into the peritoneal cavity Hamburger demonstrated that the effect of poisons was not delayed by ligature of the left innominate vein, including the thoracic duct

Muscattello and Meltzer have been the strongest exponents of lymphatic absorption Muscattello's observations, however, were principally upon granules Meltzer repeated the experiments of Starling and Tubby and noted the colors in the lymph before the urine Mendel (1898) performed the same experiments and completely vindicated the claims of Starling and Tubby

Our results are thoroughly in accord with those of Starling and Tubby, and Mendel We have utilized phenolsulphonephthalein as the solution injected into the peritoneal cavity This inert soluble chromogen is very stable, can be quantitatively estimated with accuracy in the urine The excretion of phenolsulphonephthalein by the kidney is so rapid and so uniform under normal conditions that it may be treated as a constant The urinary output represents absorption, minus a constant, and therefore negligible renal factor.

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the conditions of absorption were practically normal. No artificial pressure was used and the absorption was entirely ante mortem, thus obviating very serious objections. On account of the small amount of granular removal and the non-injection of lymph-vessels, we have been unable to throw any additional light upon the path of absorption of granules whether into the capillaries of the blood or lymph. Certainly there can be no stomata or free access to the blood or the lymphatics of the diaphragm or elsewhere, for granules of india ink or other granules of similar size.

Absorption of Bacteria and Toxins—Danielson, Wells and Johnstone, and Ruxton and Torrey have studied absorption of bacteria and have shown that practically immediately after injection of 4000 million bacteria as high as 35,000, and 5 minutes later as high as 200,000 per c c could be obtained in the blood. They think the absorption is lymphatic, but when we consider the tardiness of lymphatic absorption either of fluids or solids as shown above, it would not appear that the lymphatics could be considered such an exclusive factor in the absorption of bacteria, at least from the normal peritoneal cavity.

Oppenheimer has shown that toxins injected into the peritoneal cavity appear in the urine in 15 minutes, and that their absorption is not delayed by ligation of the thoracic duct. Injection of toxins by Hamburger produced toxic effects equally as rapidly and as thoroughly after elimination of the thoracic duct.

We can only conclude from a summation of the above experiments that lymphatic absorption of fluids from the peritoneal and pleural cavities has been greatly overestimated and that this absorption is almost exclusively hæmic. While our results have been mainly with fluids we feel that the results obtained by other authors on absorption of bacteria and toxins are so similar as to warrant the assumption that they are similarly absorbed from the normal peritoneal and pleural cavities. How far this is true for all such substances we are unable to say, the present status of the lymphatic system being very ill defined.

The results following intraperitoneal injections of phenol-sulphonephthalein may be summed up as follows:

- 1 The appearance time in the *blood* is 2-4 minutes.
- 2 The appearance time in the *urine* is 4-6 minutes
- 3 The appearance time in the *lymph* (thoracic duct) is 20-60 minutes
- 4 The quantitative output in the *urine* for 1 hour is 40-60 per cent
- 5 The quantitative output in the *lymph* for 1 hour is less than 0.1 per cent.

It can therefore be seen that the lymph plays practically no part in the absorption of these fluids. This is true irrespective of the position in which the animal is retained following the injection. The results are almost identical from the pleural cavity. Absorption of fluids from these cavities is therefore similar and almost entirely by the blood.

Absorption of Granules from These Cavities—The manner of disposal of granules injected into these cavities has been much discussed. V. Recklinghausen thought their exit was rapid and through open channels. Dubar and Remy (1882) and Maffucci (1883) thought the granules were slowly taken up by both the blood and lymph. Muscatello (1895), though disproving the stomata, asserts that the absorption is lymphatic, rapid and limited to the central tendon of the diaphragm. Kuttner (1903) thinks absorption of granules lymphatic and limited to the diaphragm, and upon this basis makes some very interesting clinical applications. We are indebted to MacCallum (1903) for a more rational understanding of the manner of absorption. He showed that foreign material is removed from these closed cavities by a very slow reactive process of phagocytosis, but most remains in the peritoneal cavity, to be encapsulated as foreign material. In our experiments we have been impressed with the extreme tardiness of granular removal from these cavities. After 2-3 hours few granules were found in the lymphatics or abdominal viscera, and at the end of this time granules were not observed in the lymph flowing from a cannula in the thoracic duct. It should be emphasized that

its consequent bearing upon the postural treatment of peritonitis definitely demonstrated

We have injected into the peritoneal cavity of dogs 20 c.c. of isotonic salt solution containing 0.6 mg. of phenolsulphonephthalein and have determined the time of appearance and the quantitative output in the urine, the animal being retained in a given position for a period of one hour.

In estimating absorption in the various postures we have no reason to assume that the parietal serosa absorbs more than its share of fluid. The collargol injections show that fluids are partly detained in the intestinal interspaces so that undoubtedly the visceral peritoneum and the omentum perform a large part of this function, but as to its relative participation it is as yet useless to conjecture. For practical purposes this is immaterial. We are concerned rather with the amount of peritoneal absorption in any given posture assumed in the treatment of peritonitis.

An analysis of these results is as follows.

- 1 There is very active absorption from the peritoneal cavity in all postures (40–60 per cent. in one hour)

- 2 The absorption in the head-down (diaphragm)³ position is practically the same as in the ventral and dorsal positions. Consequently on the basis of absorption there is no evidence of an intraperitoneal current to the diaphragm.

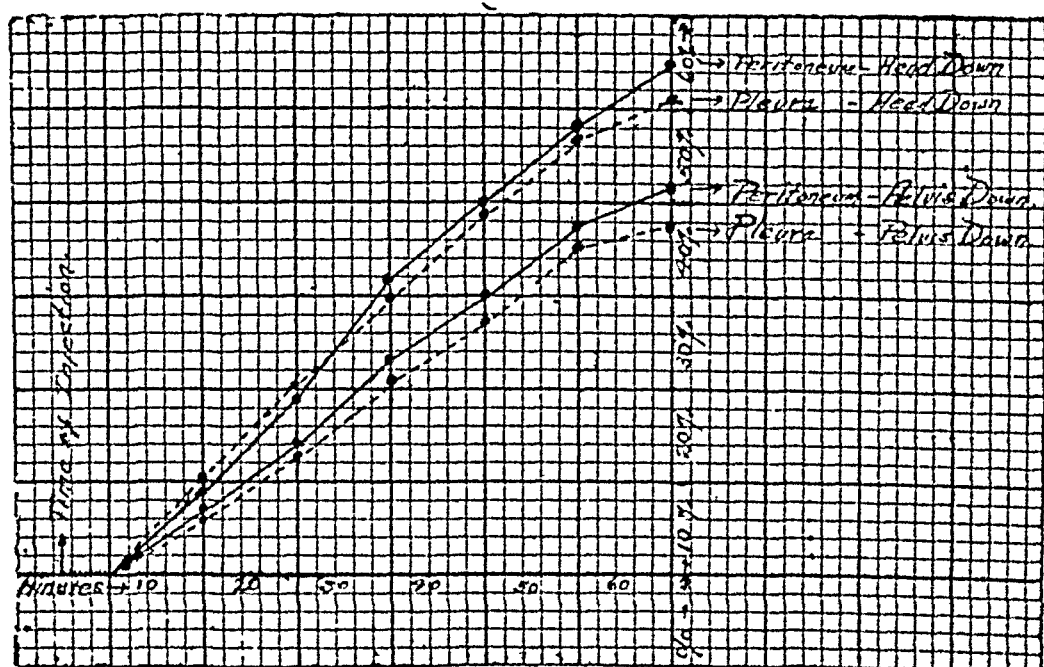
- 3 The absorption in the pelvis-down position is definitely (15 per cent.) less than in the other three positions. For this fact we have no adequate explanation.

Absorption from the Normal Pleural Cavity in Various Postures—Experiments of the same kind have been carried out for the pleural cavity. The results are strikingly similar in every way to those obtained in testing absorption from the peritoneal cavity. The appearance time and the quantitative output are practically the same. Very curiously the same dis-

* The earlier experiments showed such a parallelism in results in ventral, dorsal and head-down (diaphragm) positions that the diaphragmatic was arbitrarily chosen as representative of all three positions, to contrast with the pelvic which seemed to be definitely low.

Absorption from the Normal Peritoneal Cavity in Various Postures—A priori, it would appear grossly improbable that from over 17,000 sq cm of peritoneal serosa of practically uniform structure (an area equal to the cutaneous surface) only a small area representing the central tendon should accomplish even the greater portion of absorption of either fluids or solids. Nevertheless, such is the impression widely preva-

FIG 1



A composite curve depicting the quantitative absorption of phenolsulphonephthalein from the peritoneal and pleural cavities in canines, in the head-up and head-down positions, over a period of 1 hour, and taken at 10-minute intervals. The head-down position may be taken as representative of the ventral and dorsal positions also.

lent, and it is based principally upon the observations of v Recklinghausen previously mentioned. Yates tested the absorption of toxins in canines in the horizontal, head-up (30°), and head-down (30°) positions. His work very clearly shows the lethal effect of cobra venom to vary only within narrow limits, regardless of the position assumed, an observation which should demonstrate the fallacy of exclusive diaphragmatic absorption.

By utilizing phenolsulphonephthalein and quantitatively estimating the excretion in the various postures, we feel that this impression may with certainty be proven or disproven and

FIG. 2



The effects of gravity on the distribution of intraperitoneal and intrapleural fluids. 20 cc collargol injected 15 minutes previously. Guinea maintained in critical, head up perpendicular position.

FIG. 3



Position reversed for 15 minutes. See Figure 2. X-ray picture (Fig. 2) - 30 min head down position 15 minutes. Note infilling of collar of fluid border to upper half of abdomen and considerable change in pleural fluid, the latter clearly being practically instantaneously absorbed. Note also shape of thorax and abdomen.

the organ, variety of growth and whether the part affected is deep or superficial. For example, carcinomata of the alimentary tract from mouth to anus are permanently curable in about one-fourth of the cases (Butlin, Kocher, and Mayo); whereas carcinomata of the mammary gland give upward of 50 per cent. of five-year cures (Cheyne, Dennis, Rodman).

It is true that I have selected the best available statistics, as we will never be stimulated to greater endeavor in any other way. We want and should only be satisfied with the best, not average results.

Great an advance as this is over what was accomplished formerly, we cannot view existing conditions with indifference and should aim at something which will save nearly all, instead of half our patients. There is but one way in which it can possibly be done, and that is by operating in the precancerous stage. I am well aware that the term "precancerous" will be objected to for at least two reasons. first, that there is not always a precancerous stage, second, that when it does exist it does not necessarily mean that cancer must eventuate. Both objections are granted. The term is a convenient one, however, and in the lack of more accurate knowledge as to the exciting cause of cancer we are justified clinically in its use. I had hoped to show, and will do so in a future communication, that there are definite conditions precedent to carcinomata, variously situated, far more frequently than has been appreciated.

These conditions may be internal as well as external, and are frequent and suggestive enough to warrant the term "precancerous" and, when encountered, demand a more radical treatment than has hitherto been accorded them. Furthermore, that prompt and efficient means, entirely within our reach, nearly always either cure incipient carcinomata or, what is still more desirable, prevent them. Moreover, and it is to say the least suggestive, that such precancerous conditions are inflammatory, inasmuch as a mild, low-grade, chronic inflammation, due to long standing irritation and resulting in either ulceration, hyperplasia, or cicatricial tissue, is present in all of them.

crepancy in absorption is present in both the peritoneal and pleural cavities, *i.e.*, absorption is practically equal in all positions except the vertical, head-up position, in which it is definitely less (13 per cent.). We are also at a loss to explain this upon any histological or anatomical grounds

The Influence of Gravity on Fluids in the Peritoneal and Pleural Cavities.—From the stand-point of operative treatment it is important to know if, by posture, infectious products can be segregated in selected areas where drainage is easier, the environment more propitious, and the subsequent complications of less importance. Naturally the most suitable location from these points of view is the flank or pelvis and the least suitable is the upper abdomen. Opinion is divided as to the effect of gravity on the localization of fluids in the abdomen and thorax.

By injecting collargol into the peritoneal and pleural cavities of dogs and later making an X-ray examination we have been able to observe the effect of gravity on fluids in these cavities. These examinations demonstrate that gravity exerts a very important influence in determining the localization of fluids. In the pleural cavity gravitation is practically instantaneous, in the peritoneal it is slower, its course being retarded and the direction influenced by the intestines. There is no evidence of an intraperitoneal current to the diaphragm

CONCLUSIONS.

1. There is very active absorption of fluids from all parts of the normal peritoneal and pleural cavities
2. This absorption is essentially hæmic and not lymphatic.
3. We have quantitatively determined the absorption of fluids in both cavities in the four postures.
4. Peritoneal absorption is practically equal in all postures except pelvis-down, in which it is 15 per cent. less than in the others
5. Pleural absorption is practically equal in all postures except pelvis-down, in which it is 13 per cent. less. The explanation of these findings we are unable to give
6. The visceral peritoneum undoubtedly plays an important

SUBCUTANEOUS TRAUMATIC RUPTURE OF THE NORMAL SPLEEN.

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By the normal spleen is meant one that is not hypertrophied from malaria, anæmia, neoplasms

History—Aristotle and Paracelsus both speak of the removal of the spleen and say that it is an organ not essential to life It is an old belief, still prevalent, that the spleen is a hindrance in running Carstens and Brogsitter mention instances The latter gives interesting information of the etymology, and the history of splenectomy for rupture The various derivations are in anatomical, physiological, and psychological senses Anatomically from *λαῖος*, lævus, left side the French “rate” meaning of irregular, reticular structure Physiologically from *σπλην*, attracting malignant tumors to itself

The earliest reported splenectomies were in 1549, by Fioravanti and Zaccarrelli, and another in 1541, both successful. In the next 100 years there were various cases reported, all agreeing that the spleen was not necessary to life In 1855 there was a great controversy in Germany over the propriety, or advisability, of splenectomy, and as Simon, the then most influential surgical authority, opposed, the operation was abandoned temporarily Ten years later, however, it was taken up and advocated by Spencer Wells Most of these early cases were in diseased spleens Splenectomy for subcutaneous traumatic rupture was advised theoretically by Kucher in 1855. Kuchenmeister in 1866, Mayer in 1878, and Nussbaum and Edler in 1877. John Bell classed ruptures of the spleen with wounds of the heart as to their seriousness and dangers, so that anything like successful surgical treatment of these in-

part in absorption—probably a more active part than the visceral pleura

7 We have no evidence to support the view that there is an intraperitoneal current to the diaphragm

8 There is no evidence in favor of the claims that the central tendon or the diaphragm as a whole performs more than its proportional amount of peritoneal absorption

9 Gravity has a decided influence upon the localization of fluids—rapid in the pleural cavity, much slower in the peritoneal cavity The intestines delay and influence the gravitation of fluids in the abdominal cavity

10 From the above, we conclude that though Fowler's position as originally instituted was based upon entirely fallacious and disproven grounds, there is herewith adduced evidence of a different character, perhaps sufficient to justify the resort at times to this postural method in the treatment of acute diffuse peritonitis The above results tend also to support the employment of Coffey's lateral modification of Fowler's position

No free bleeding points seen; profuse general oozing. Three large pieces of gauze packed against wound of spleen pushing it against ribs and diaphragm. As much blood and clots as possible wiped out with gauze, and lower end of wound closed with interrupted through-and-through sutures of silkworm gut. Lower incision closed with small wick to pelvis. Intravenous salt solution; no stimulants. For 24 hours condition critical, then gradual improvement until end of twelfth day when tampons were easily removed. Discharged in good condition at end of sixth week. Blood normal. Five months after injury patient is well with no hernia at splenic wound.

In a search of the literature since the compilation of Brogsitter (1909) I have found reported the following cases of subcutaneous traumatic rupture of normal spleens (in chronological order):

1 ELIOT Female, thirty-four Fell 9 ft. Five hours later pulse 132, left side abdomen rigid, dullness left flank, fracture eighth and ninth ribs. Six hours after accident splenectomy. Well 55 days later.

2. LECÈNE Male, fifty Squeezed between wall and cart. Two hours later marked contraction of abdominal wall, especially on left, severe pain left hypogastrium with tenderness. Pulse 80. Pale. Splenectomy. Well.

3 FAGGE. Girl, thirteen Knocked down by motor. Next A.M. abdomen rigid, tender, distended, most marked signs in upper left. No signs of fluid. Restless, pale. No diagnosis. Incision median line, liver explored first. Spleen almost torn in two. Splenectomy. Spleniculus found attached to gastrosplenic mesentery. Discharged in 6 weeks, with no lymphatic enlargements. Five months later well in every way.

4 ROSS (not the case in Brogsitter) Male, twenty-one Fell. Walked home. Pain in epigastrium and left abdomen. Twenty-four hours later severe abdominal pain, rigidity, distention, rapid, weak pulse. Hamoglobin 48 per cent. Leucocyte count 20,000. No diagnosis. Operation, tampon. Slow recovery.

5 ELIOT Male, forty-five Run over. No signs of injury. Temperature and pulse normal. End of third hour pulse up to 100, little pain, no vomiting, no shock. In 5 hours acute pain, with rigidity and dullness in left flank. Incision parallel with costal border. Splenectomy. Well.

6 LUKIS Male, seven Run over by van. Abdomen tender, rigid, resonant. Pain in left lumbar region. No signs fluid in abdomen. Too weak for operation. Pulse 140, irregular. Temperature 99, respiration 31, shallow. Eight hours later pulseless. Ten hours later improved. Operation, forty-two hours after admission. Lower third spleen almost separated, laceration near hilum, not bleeding. Splenectomy. Recovery.

juries is fairly modern. Before 1874 the mortality of splenectomies was 90 per cent, due to lack of asepsis, faulty technic, and often operating under false indications such as in cases of leukæmia and amyloid. Recent statistics giving all cases of ruptured spleen in the literature have been published by Bessel-Hagen, Berger, Carstens, Neck, Johnson, Hertz, and Brogsitter (Planson's work, 1909, has not been available).

Neck, in 1905, gives 73 cases of uncomplicated rupture, with a mortality of 37 per cent. Brogsitter, 1909, gives 47 cases of rupture of the normal spleen with these results: splenectomy 64 per cent well, 35 per cent dead, tampon 6 cases well, suture 1 case well; suture and tampon 1 case well.

The following case was admitted to my service at the Cambridge Hospital July 8, 1913.

Male, nineteen years, no previous illness. Fell 25 feet from a staging, picked up conscious and brought to accident room. Examination one hour after accident showed spare, muscular boy, with light, sallow complexion; Colles' fracture of left wrist, small abrasions on face and chest, abdomen negative. Pulse 70, temperature and respiration normal. Catheter specimen of urine negative. Complains of pain in left side. Next day pain in left lower abdomen, especially left inguinal region, where muscles are rather tense, and where there is tenderness on pressure extending into the small of the back. Otherwise abdomen and other examinations negative. No signs of fluid in abdomen. No vomiting. Temperature and pulse normal.

Second day. Sudden change for worse this A.M. Vomiting. Severe pain over the whole abdomen, abdominal muscles rigid, tenderness localized low down in left iliac region. *Operation*—Ether. Diagnosis of probably ruptured intestine, with incision in median line below umbilicus on account of low localization of pain. On entering cavity a gush of dark fluid and clotted blood. Incision packed temporarily with gauze, and second incision made from costal border downward at edge of left rectus. Lower third of spleen found shattered into a pulpy mass, surrounded by blood clots and detached pieces of splenic tissue. In scooping these out with the hand a spleniculus, intact, the size of a walnut, with part of its mesentery attached, was found among the clots.

18 BURNIER. Male, seventeen Squeezed between cart and bus Pale, weak, pulse 70, few ecchymoses on abdomen Diagnosis, shock One hour later sudden change, restless, pulse 140, respiration hurried, temperature sub-normal Pain on both sides abdomen, more on left, some distention Diagnosis, internal hemorrhage Operation $2\frac{1}{2}$ hours after accident, tear at hilus bleeding freely, splenectomy Died Autopsy shows nothing Cause, shock plus operation

19 CURCHOD Male, fourteen Fell 36 ft Abdomen very tender, especially in epigastrium, muscular rigidity, no vomiting Operation 1 hour after accident Median incision Transverse tear in anterior border of spleen Sutured with catgut Wound closed tight Convalescence prolonged by lesion, probable fracture of fourth cervical vertebra

20 FILBRY Male Run over. Got up himself Two hours later pain in right clavicle and breast, and lower abdomen Much distended and tender, liver dulness increased, pulse 76, 6 hours later vomited twice, severe pain in upper abdomen Diagnosis, rupture liver or spleen Spleen torn in two Splenectomy In splenic bed was a spleniculus Small tampon to region Well three weeks later.

21 JONES Male, thirty-seven Intoxicated, hit by cab General abdominal pain, bruises *right* iliac region Next day signs of internal bleeding, with distention and dulness in right flank Diagnosis, ruptured liver Incision right rectus, cross incision to left, splenectomy. Well

22 RIGOLLOT-SIMONNOT Male, thirty-eight Fell hitting left side on bus, got up and took next one, 15 minutes later pain in abdomen Fainted Six hours later cold extremities Pulse 110, abdomen contracted, very tender, dulness both flanks Median incision Splenectomy. Drained Well

23 NAST-KOLB Male, thirty-eight Kicked in left chest One hour later, tender swelling left breast, slight muscular rigidity upper abdomen, pulse 84 In evening vomited once Second day, abdomen soft. Third day, vomited once, pulse and temperature normal Fourth day, wants to get up, while straining on bed-pan sudden collapse, dulness in splenic region, vomiting Diagnosis, ruptured spleen Splenectomy Died in 4 hours Autopsy, intense anemia of all internal organs No coagula in tears of spleen, no separation of capsule

24 CHARRIER and BARDOV Male, eighteen Run over by wagon wheel Intense pain in left hypochondrium, very thirsty, no vomiting Fourteen hours' later, dyspnoea, pale, groaning with severe pain, abdominal muscles tense, especially on left, slight dulness iliac fossae. Diagnosis, abdominal accident Operation 16 hours after accident, splenectomy; Discharged 35th day

25 STRAUSS Male, seventeen Fell 10 ft In bed 4 days without treatment, pain in left side, sent to hospital in wagon, $\frac{1}{2}$ hour ride, not admitted, returned 3 days later by foot and tram, pain in left side, flatness up to angle of scapula, otherwise negative, in bed 2 days On fourteenth day got up, collapsed, vomited, rapid pulse, abdomen distended and tender, by rectum a tender swelling—punctured, gave dark fluid blood. Diag-

7 CORNER Male, nine Fell down stairs Vomited once Shock on admission Two hours later pulse down from 98 to 86, but boy "looked bad" Area of flatness over splenic region Splenectomy Well

8 HOFFMANN Male, sixteen Fell, striking left side on iron hoop. Vomited once that night Next day pale, slightly cyanotic Pulse 120, abdomen distended and tender on pressure Dulness in left flank Diagnosis, ruptured intestine or spleen, more likely former Median incision Splenectomy Well

9 HOFFMANN Male, eighteen Kicked by horse in left side Lips cyanotic Pulse 110 Abdomen soft, not tender on pressure Liver region sensitive Dulness both flanks Diagnosis, ruptured liver or spleen Operation ten hours after accident Median incision Three tears in anterior surface of spleen Suture attempted, splenectomy Well

10 CHAMBERS Male, twenty-five Run over by light trap with rubber wheels Severe collapse Recti rigid, general tenderness, left flank dull not changing with position Some dulness in right flank Operation 1 hour later Splenectomy Ligature pedicle with needle and catgut Two hours later signs bleeding Opened General oozing from splenic bed Packed with gauze Fed bone marrow Well

11 LEITNER Boy, twenty Run over by wagon, jumped on again and rode for half hour, then sudden abdominal pain Examination 4 hours later, no signs trauma, both recti rigid Diagnosis, some intestinal injury Operation, piece of spleen torn off, packed with hot towel, recovery

12 VIART Boy, nineteen Fell 6 ft Two hours later pale, respirations short and rapid, pulse 110, severe abdominal pain, especially in iliac fossæ No dulness Diagnosis, ruptured spleen, refused operation Ten hours later much weaker, consented Splenectomy Well

13 VORWERK Male, nineteen Splenectomy Nine and one-half months later, can only do light work, some glandular enlargement, skin and mucous membranes pale

14 VORWERK Male, seventeen Diagnosis, rupture spleen Splenectomy 6½ hours after accident, 9 months later fine condition, general glandular enlargement to size of bean No pallor

15 VORWERK Male, twenty-four Run over Diagnosis, rupture of liver or spleen Median incision, cross incision to liver which was uninjured, cross incision to spleen, splenectomy No drainage Three months later looks pale, pain in wound, coagulation time delayed

16 MUHSAM Male, ten Run over Pulseless, white, abdomen shows signs of much free fluid, changing with position (No other symptoms given) Diagnosis, rupture of spleen Splenectomy End of first week fever with leucocytosis of 80,000 Recovery

17 LILIENFELD Male, twenty-one Fell Soon after passed blood by urethra Six hours later pale Pulse 80, tender in left flank Tension of upper abdomen, no vomiting Diagnosis, ruptured spleen or intestine, injury to left kidney Twelve hours after accident operation, tears

lower pole of spleen, retroperitoneal hæmatoma near left kidney
omy No drainage Rapid recovery

for a time it is strictly local. It may remain so for weeks, months or years, varying with the organ affected, the abundance of its lymphatic supply and possibly other influences of which we know little. The evidence that carcinoma is at first strictly local is so complete and overwhelming as to leave no possibility for doubt, if one carefully considers it and is uninfluenced by the masters of a former generation, who were as slow to acknowledge and put into practice the discovery of Moore as they were to accept the inestimable blessing offered to them by Lister.

If the disease were constitutional one could never hope to effect a cure by local measures, and so long as they were practised in a partial, incomplete, and faint-hearted manner upon unfavorable cases a cure practically never resulted. But when operative limits were extended even unfavorable cases were sometimes, but rarely, cured. More extensive procedures upon average cases brought a still greater measure of success, and now, free removal of early lesions is generally followed by a permanent cure. Operations for mammary cancer yield 80 per cent of cures if practised before the disease has spread to the nearest lymph-nodes, and a larger per cent of early, strictly local carcinomata of the lip and larynx yield to excision. According to Judd, 93 per cent of the traced cases of epithelioma of the lip at the Mayo clinic were permanently cured. Sir Felix Simon reports 85 per cent. of cures in local laryngeal growths.

But, unfortunately, there is no way by which a clinical diagnosis of cancer can be made with certainty even after it has ceased to be strictly local, much less can it be done beforehand. Taking all cases as they present themselves to us at the present time—early or local ones, fairly early or those with moderate involvement of the nearest chain of nodes, and unfavorable or late ones, in other words, where there is greater infiltration of the tissues around the original focus and more extensive glandular infection, but still safely removable by the knife—we must be content with a number of five-year cures ranging from 10 to 50 per cent. and upward, varying with

nosis, mesenteric embolus Laparotomy, splenectomy Very deep tears filled with thrombi Well

26 CLARKE Man, fifty-two. Seen two days after fall, pain in epigastrium, some distention, dulness left flank Exploratory laparotomy, splenectomy Well Fed bone marrow and sheep's spleens

27 and 28 MCCOY Two cases splenectomy following rupture, well 16 and 17 months after

29 KAHN Male, eleven Fist blow left side, 2 hours before entrance Collapse, with severe pain in *right* hypochondrium No vomiting Pulse 126-150, temperature 98.6, respiration 36, marked abdominal rigidity, shock, no dulness on left Operation 1 hour after admission Median incision, jagged tear in upper pole of spleen, packed with gauze, removed eighth day Well.

30 RAIT Male, thirty-two Blow 3 hours before entrance. Pulse 76, shifting dulness is only marked symptom of abdominal trouble Grew rapidly worse during preparations for operation No diagnosis Median incision, splenectomy Well Spleen showed one tear 1 in long in lower margin, normal size and appearance (Calcutta)

31 Author's case

This summary includes all the cases reported in this classification from 1909 to November, 1913, except the following, which have not been available, and may or may not be ruptures of the normal spleen Okinskivich, *Med Obozr Msk.*, 1907, lxviii, 889, Oller, *Rev Spec Med Madrid*, 1909, xii, 417-424, Mallett, *Med rev.*, xvi, 321; Vaccari, *Ann di med nav Roma*, 1909, ii, 533, Kopiloff, *Khur Mosk*, xxx, 614, Lindstrom, *Nord Med Arch Stockholm*, 1911, ix, 80, Steinthal, *Med Cor Bl d wurtem artzl*, 1911, lxxxii, 190, Wille, *Norsk Mag f Laegevidensk*, 1911, 5, R, ix, 722

Of these 31 cases reported 26 were treated by splenectomy with 2 deaths, a mortality of 7.6 per cent, Brogsitter's collection showed 34 splenectomies with 12 deaths, a mortality of 35.3 per cent, progress in surgery or a decline in reporting bad results? Four treated by tampon and one by suture with no deaths Brogsitter's figures here were respectively 6 and 1 with no deaths

Etiology—There are various theories to account for these subcutaneous traumatic ruptures in health A large percentage of them occur in children, workingmen, and young adults, as naturally they are more exposed to injury And yet

tried and need only be mentioned here. Senn's method of crushing the edges of the splenic wound with forceps, and then suturing, was successful in dogs, but any kind of suturing of the human spleen is too difficult and too uncertain, notwithstanding the success of Curchod in case No. 19 here. Sheldon, in dogs, clamped the splenic vessels for 4 hours, letting the blood in the spleen drain out, avoiding tampon and consequent thrombosis of vessels in the spleen. At the end of this time the clamps were removed and there was no bleeding. The dogs killed from 1-3 weeks later showed spleens with good circulation and no areas of necrosis. So far as I know this has not been tried in man.

Splenectomy has been the prevailing treatment, and the only one advocated by most of the writers, until Brogsitter, who realizes the value and possibilities of tamponade. This method has found more favor with American and English surgeons (4 of Brogsitter's 6 cases, and all 4 of my cases). In injuries involving the hilus of the organ, where large vessels are torn, I believe that splenectomy is still indicated.

Otherwise tamponade is the "ideal treatment," if by "ideal" we mean the method offering the best chances for a living and organically intact patient. From the point of view of surgical technic only is splenectomy the ideal form of treatment. My reasons for this view are

- 1 The statistics of tamponade, admittedly few but nevertheless reassuring, are: Berger 6 cases, 1 death, Brogsitter 6 cases, no deaths, cases here 4, no deaths. A total of one death in all of the 16 cases reported to date. (A case of Brewster, omitted by Brogsitter apparently, recovered with tampon.)

- 2 Increased danger to the patient of adding the shock of splenectomy to the shock of his injury. The nerve supply is abundant, from the splanchnic nerves and cœlic ganglia. Tamponade is quicker.

- 3 Structurally and geographically the spleen is well suited to treatment of hemorrhage by tampon. With a good exposure of the operative field all tears can be felt and there need be no danger of bleeding posteriorly into the lesser cavity.

the small percentage (13 per cent Berger) in men over fifty, with whom falls and blows are usually serious, suggests the possibility that there may be some anatomical or physiological cause of the frequency of this accident in the young.

Nearly half of all subcutaneous ruptures are in diseased, enlarged spleens (Berger), where they may be said to be hyperfunctionating. The frequency of such cases not reported, especially in malarial countries, is shown by a report of Sutherland of judicial autopsies in the district of Saugor (India), where from 1900-1908, of 295 deaths 27 were from ruptured spleens, most of them twice the normal size.

Hoffmann suggests as a cause of rupture in health the greater pliability of the sternum in the young; transmitting the force of the blow, where in the old there is more resistance and fractured ribs result. Berger's theory is hydraulic pressure, comparing the spleen to a vessel full of fluid, which it practically is. Spontaneous ruptures, during pregnancy or confinement, in all of which there has been enlargement, mostly from malaria, and ruptures of enlarged spleens from a very light blow, can hardly be explained otherwise. Johansson quotes the experiments of Petersen, who was unable to rupture normal spleens with a hand pump, while those diseased gave way readily. Brogsitter gives most importance to the splenic ligaments; and supposes a deep inspiration occurring reflexly with the blow. Probably there are factors in all these ideas. To put it as simply as possible: surrounded by the ribs, diaphragm, ligaments more or less tough and always resistant, kidney, pancreas, stomach and intestines often filled with food, is a very friable organ, built like a sponge of connective tissue and a few unstriated muscle fibres, filled with blood, at a pressure of 120-150 mm of mercury, and covered with a fibrous capsule. The transmitted force of a blow or fall finds it less resistant than its neighbors.

Signs and Symptoms —Pain is the first symptom; from a blow, more likely to be localized in the splenic region; after a fall, more frequently felt all over the body, or through the

splenectomy where tamponade would have stopped the bleeding.

Technic—A median incision under local anæsthesia is the best, as the diagnosis is usually uncertain. From the upper end of this incision a cross incision, following the border of the ribs, gives a good field for determining the extent of the injury, and for splenectomy should it be necessary. Resection of the lower rib cartilages has been recommended by Auvray, Lejars, Lotsch, Rabinowitch, and Kocher (Brogsitter cit), but it is probably not necessary unless the spleen is enlarged. The definite contra-indication to splenectomy is leukæmia or pseudoleukæmia.

Conclusions—In the diagnosis, local abdominal signs (the results of hemorrhage) are seen earlier than the general signs of hemorrhage. The leucocyte count should be watched carefully in the absence of other definite signs. Make an early exploratory abdominal incision under local anæsthesia when suspicious signs and symptoms follow an injury or fall. The spleen may be ruptured with remarkably few evidences of it. Preserve the spleen if it is possible to tampon the injured area.

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4. The possibility of lessening the motility of the stomach or colon from adhesions is not a serious contra-indication—witness the various operations such as Rovsing's

5. The economical value of the spleen in our physiology In spite of the cases which have lived in reported health for years without the organ—Pean's 13 years, Vulpius's 15 years, Adelman's 23 years (Vorwerk's cit)—the more work that is done in the physiology of the spleen the more evident it becomes that it is not an organ to be sacrificed for a few tears if the hemorrhage can be stopped in some other way. (See present work of Vogel, Asher, and Pearce) All splenectomies show a hæmoglobin of about 70 per cent, and the presence of transitional forms of blood cells for a varying length of time; signs of a serious disturbance. Compensation is often established so slowly that patients are invalids for the first year at least Tamponade gives a more rapid convalescence Only a small proportion of splenectomies have been followed with sufficient care for any number of years, and experimental work has been conflicting and contradictory Kanavel concludes from his work on dogs that non-union of fractures cannot be attributed to loss of the spleen, but in splenectomized men repair has been long delayed. Hubbard worked with guinea pigs and concluded that there was no diminution of resistance to infection from splenectomy He reports a case of his own perfectly well three and three-quarters years after operation, and reacting normally to a quinsy throat. But other experimenters have obtained conflicting results, as shown by Danielson What the spleen does with iron we do not know definitely, we do know that after splenectomy the formation of bile pigments is interfered with and their amount reduced; and that less trypsin is secreted by the pancreas A point to be remembered is that the function of the spleen varies much in different species, and one must be careful in assuming that experimental results in animals will hold good for man. There is no proof yet that splenectomy in man makes him peculiarly susceptible to infections But one cannot help feeling in studying reported cases that many spleens have been sacrificed by

HERNIA OF THE LARGE INTESTINE

WITH SPECIAL REFERENCE TO "SLIDING HERNIA"

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ALTHOUGH first described by Scarpa, this variety of hernia did not receive much attention until the French surgeons began to study the subject. The German articles are few and far between, although an excellent article on the subject has been written by Sprengel (*Archiv f. klinische Chirurgie*, vol 95, page 702). In this country Weir (*Medical Record*, February 24, 1900) gave the subject an excellent résumé, and published cases of his own.

Judging by a personal experience, this form of hernia is of more frequent occurrence than one would be led to assume by the number of cases reported. This can be accounted for in two ways, either the hernia has not excited sufficient interest in the operator, or (which in the writer's opinion is more likely) the operator did not wish to be reminded of a rather unpleasant experience.

The operation for the radical cure of a hernia of the large intestine may be one of exceptional difficulty, it is important, therefore, that the surgeon bears the possibility of its presence constantly in mind. He must, in addition, be well acquainted with all the forms and possibilities of such a hernia, inasmuch as considerable, and often irreparable damage may be done.

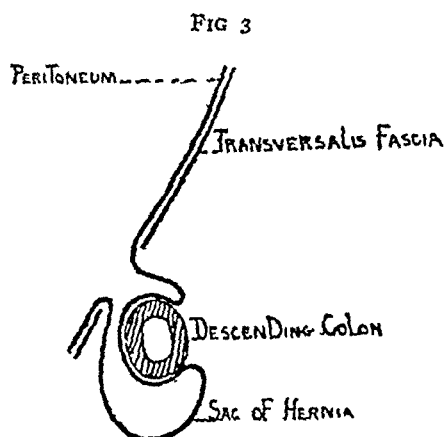
The five divisions of the large intestine, viz, cæcum, ascending, transverse and descending colons and the sigmoid flexure, all have their peculiarities when met with in a hernia, it is necessary, therefore, to discuss each division separately.

Before proceeding to the individual description of these

* Read before the New York Surgical Society, Dec 10, 1913

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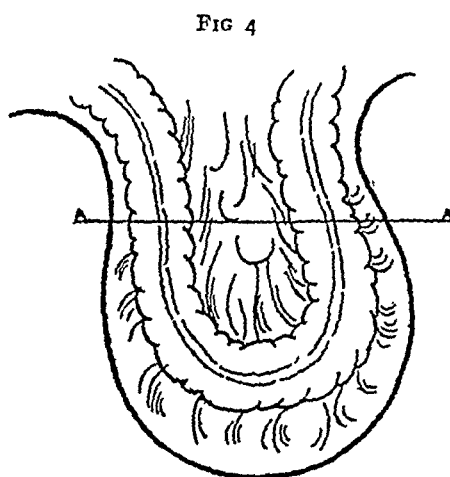
The sigmoid flexure, being covered on all sides by peritoneum, does not necessarily differ from a loop of small intestine, but the descending colon is usually covered only on three sides by peritoneum, it is evident, therefore, that after being



Sliding hernia of descending colon by "pulling" mechanism Third stage

pulled down, the descending colon will form part of the posterior surface of the sac. This is one variety of sliding hernia, and may be termed a "sliding hernia by pulling."

Let us now imagine the following. For the purpose of



Sliding hernia of descending colon by "pulling" mechanism

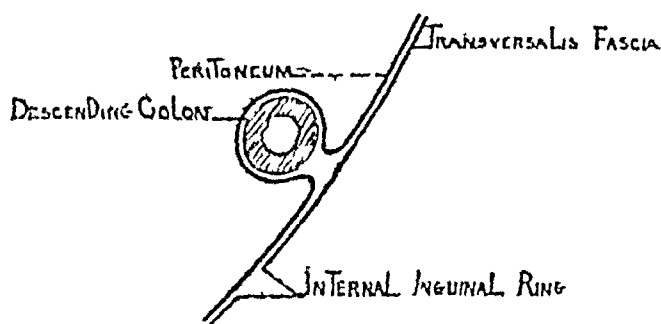
our experiment, the descending colon has again been loosened, as in the preceding assumption. Let us now suppose that pressure or force has been applied over the descending colon, just above its junction with the sigmoid flexure, the direction of this

subvarieties, it is necessary to call attention to a phenomenon peculiar to herniæ of certain portions of the large intestine.

This phenomenon has been called by the French "*hernie par glissement*," or translated into English, "sliding hernia."

It is difficult to give a short description of this phenomenon;

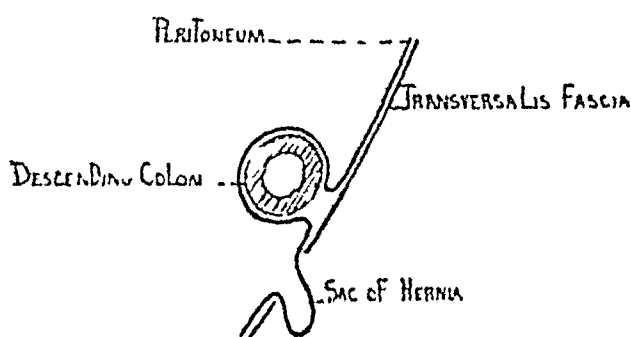
FIG 1.



Sliding hernia of descending colon by "pulling" mechanism First stage

but a clear mental picture of this hernia can be obtained in the following manner Let us imagine, for instance, that the peritoneal attachments of the descending colon have become loosened from the subjacent structures, so that the colon, instead of being a fairly fixed structure, now moves easily in

FIG 2



Sliding hernia of descending colon by "pulling" mechanism Second stage

its bed, let us then imagine, that the peritoneum in the neighborhood of the internal inguinal ring is grasped, and then pulled in the direction of the scrotum What will happen under these circumstances? First, a hernial sac is being pulled out, and eventually the sigmoid flexure and descending colon The successive steps of this procedure are illustrated in Figs. 1-5

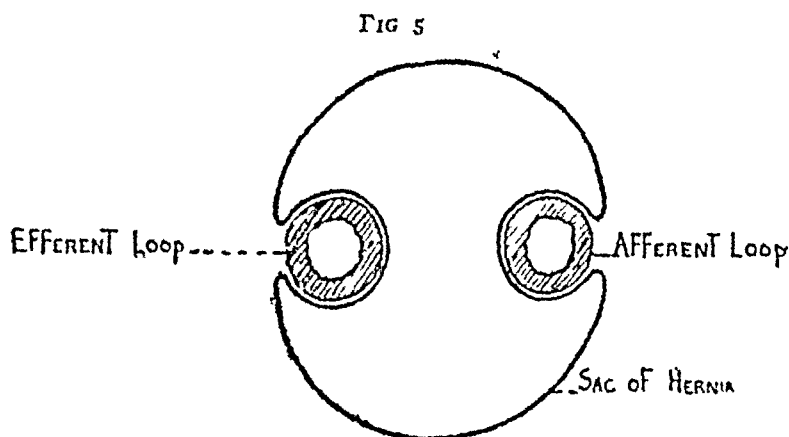
is well to be acquainted. Herniæ by pulling are usually very large, herniæ by pushing are very small. Herniæ by pulling usually have a very large sac, herniæ by pushing usually have no sac at all. In the herniæ by pulling, the nutrient vessels of the gut are usually pulled down with the gut, in the herniæ by pushing, the nutrient vessels need not necessarily be in the hernia.

If this pathogenesis is borne in mind, it becomes evident that only those parts of the large intestine can be involved in a sliding hernia, which are not covered on all sides by peritoneum. It is manifest, therefore, in spite of assertions to the contrary, that the ascending and descending colon are the only parts of the large intestine that can enter into the composition of a sliding hernia. Most authors speak of the sigmoid flexure as the sliding organ, but this is manifestly incorrect.

Before making a statement so radically different from the conventional view, it is necessary to define precisely what part of the large intestine is meant when we say "sigmoid flexure." Unfortunately even anatomists are not agreed, and call this part of the intestine by different names, such as sigmoid flexure, S. romanum, iliac colon, pelvic colon, S. iliac, etc., etc. The writer prefers to adhere to the orthodox nomenclature according to which the sigmoid flexure is that part of the large intestine, which has throughout its entire extent a well-defined mesentery, the mesosigma; in contra-distinction to the descending colon, which is covered only on three sides by peritoneum.

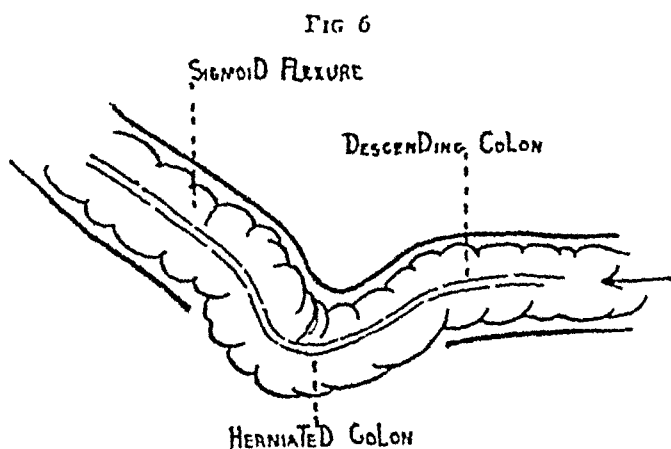
However, the distinction as to whether an organ is completely or incompletely covered by peritoneum is a very narrow one. Broadly speaking, there is no organ which is completely surrounded by peritoneum. All the organs are in fact extra-peritoneal, being merely tucked to a greater or lesser extent into a closed peritoneal sac. It also follows, therefore, that almost every organ under favorable conditions may become the sliding part of the sliding hernia. Thus, for instance, we speak of the small intestine as having a complete peritoneal investment, yet in very large herniæ upon the right side, in which the cæcum and ascending colon are pulled down, so

force must be first backward, then downward and inward, toward the internal inguinal ring. What happens under these circumstances? First, the anterior wall of the descending colon is approximated to the posterior wall; the force continuing



Diagrammatic cross section of sliding hernia of descending colon by "pulling" mechanism
Section made at AA in Fig 4

against the posterior wall, this segment of the descending colon is pushed nearer and nearer to the internal inguinal ring, until finally it is pushed out behind the peritoneum into the inguinal canal (Fig 6). We now have a true hernia without any in-



Sliding hernia of descending colon by "pushing" mechanism, so called sacless hernia

volvement of the peritoneum, *i e.*, a sacless hernia. In contradistinction to the first variety this may be termed a "sliding hernia by pushing"

Both of these herniæ occur with about equal frequency. There are certain differences between the two, with which it

much of the mesentery of the small intestine may become unfolded and enter into the formation of the huge sac, that even the small intestine may appear as a sliding hernia. Similarly upon the left side, while we speak of the sigmoid flexure as having a complete peritoneal investment, the sac may be so large, that the mesosigmoid becomes unfolded, and the sigmoid flexure itself may become the sliding part. But these are rare instances; the writer has never seen the sigmoid flexure as a sliding hernia, but has seen a case of sliding hernia of the small intestine in which the hernia reached way below the knee. On the other hand, the broader the uncovered area of a viscus, the greater is the likelihood of this viscus being found to be the sliding part of a sliding hernia.

On theoretical grounds we may, therefore, divide the abdominal organs, according to their likelihood of entering into the formation of a sliding hernia, into the following groups

Always.	Never	Rarely	Likely
ureter	ovary	sigmoid flexure	ascending colon
	stomach	small intestine	descending colon
	liver	uterus	broad ligament
	spleen	Fallopian tube	bladder
	transverse colon		appendix
	cæcum		
	omentum		

Finally, the writer wishes to state, that by the above description he only refers to the sliding organ, which has nothing to do with the hernia. In other words, we may have combinations, thus, for instance, there is nothing to prevent the ovary from being in a sliding hernia of the descending colon, in such a hernia, the ovary is merely an accidental content of the hernia, but the sliding part is the descending colon only.

Assuming the correctness of the pathogenesis of sliding hernia that we have set forth, it becomes self-evident that the terms "hernia of the large intestine" and "sliding hernia," are by no means synonymous. This mistake is only too frequently made in medical literature.

All herniæ of the large intestine, whether sliding or not,

the organ, variety of growth and whether the part affected is deep or superficial. For example, carcinomata of the alimentary tract from mouth to anus are permanently curable in about one-fourth of the cases (Butlin, Kocher, and Mayo), whereas carcinomata of the mammary gland give upward of 50 per cent. of five-year cures (Cheyne, Dennis, Rodman).

It is true that I have selected the best available statistics, as we will never be stimulated to greater endeavor in any other way. We want and should only be satisfied with the best, not average results.

Great an advance as this is over what was accomplished formerly, we cannot view existing conditions with indifference and should aim at something which will save nearly all, instead of half our patients. There is but one way in which it can possibly be done, and that is by operating in the precancerous stage. I am well aware that the term "precancerous" will be objected to for at least two reasons. first, that there is not always a precancerous stage; second, that when it does exist it does not necessarily mean that cancer must eventuate. Both objections are granted. The term is a convenient one, however, and in the lack of more accurate knowledge as to the exciting cause of cancer we are justified clinically in its use. I had hoped to show, and will do so in a future communication, that there are definite conditions precedent to carcinomata, variously situated, far more frequently than has been appreciated.

These conditions may be internal as well as external, and are frequent and suggestive enough to warrant the term "precancerous" and, when encountered, demand a more radical treatment than has hitherto been accorded them. Furthermore, that prompt and efficient means, entirely within our reach, nearly always either cure incipient carcinomata or, what is still more desirable, prevent them. Moreover, and it is to say the least suggestive, that such precancerous conditions are inflammatory, inasmuch as a mild, low-grade, chronic inflammation, due to long standing irritation and resulting in either ulceration hyperplasia, or cicatricial tissue, is present in all of them.

small intra-abdominal part of the cæcum. It is as though the cæcum was partly bent upon itself, like a hammock. This is the so-called "hernie par bascule."

b. Hernia of the Ascending Colon.—It has already been noted that the ascending colon occurs in an inguinal hernia only in the form of a sliding hernia (exception of course must be made for those isolated cases, in which the ascending colon has a complete mesentery). Furthermore, that it may occur in two different forms: first, in large herniæ, the pathogenesis of which is explained by a "pulling" mechanism, in this case the ascending colon is frequently accompanied by other viscera in the vicinity of the internal inguinal ring, viz., the cæcum, appendix, small intestine and omentum. And second, in small herniæ, the pathogenesis of which may be explained by a "pushing" mechanism; this second form may be entirely devoid of a sac, and may in consequence be very baffling. It is true, there may be a very minute sac toward the mesial side of the gut, but this is expected owing to the dislocation of the intestine.

c. Hernia of the Transverse Colon.—The transverse colon for practical purposes has a complete peritoneal investment; it is, therefore, never the sliding portion of a sliding hernia. In any event, it is a rare hernial content, and then only in those of extreme size, and when the organ is prolapsed. Being completely invested by peritoneum, its reduction never causes any difficulty.

d. Hernia of the Descending Colon.—With negligible modifications the remarks on herniæ of the ascending colon apply equally to those of the descending colon.

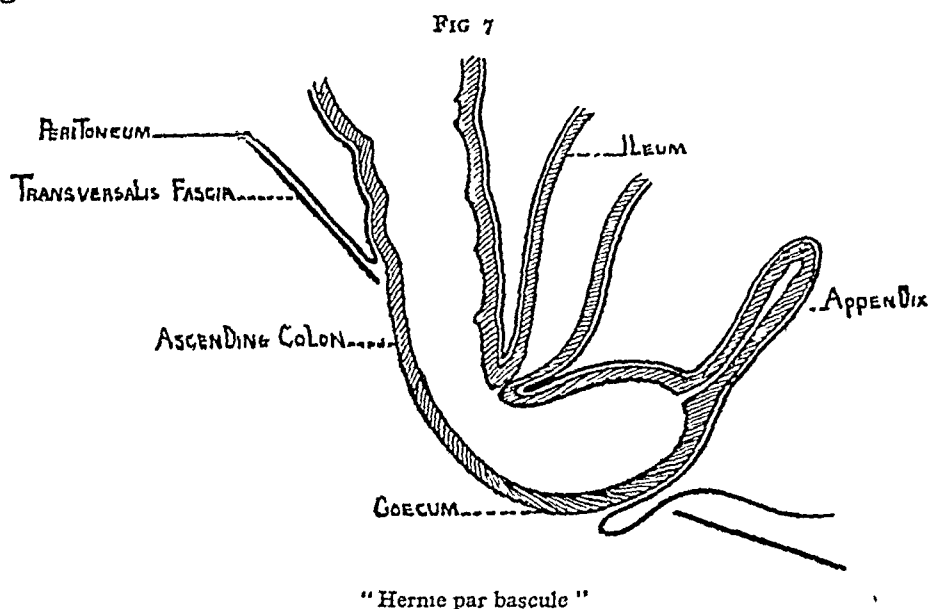
e. Hernia of the Sigmoid Flexure.—Most of the special articles on sliding hernia speak of herniæ of the sigmoid flexure as a type example of sliding hernia. The reasons why the sigmoid flexure, except under unusual conditions, cannot form the sliding part of a sliding hernia have already been discussed.

Treatment.—The treatment of uncomplicated herniæ of the cæcum, transverse colon, and sigmoid flexure, is no different from any other simple form of inguinal hernia.

The treatment of sliding hernia, however, *i e*, the treatment of herniæ of the ascending or descending colon is an entirely different proposition. There is hardly any operation that may tax the patience and technic of the best equipped surgeon more.

have certain other peculiarities, according to the organ prolapsed

a Hernia of the Cæcum—Anatomists have described various forms of the cæcum. For our purpose it is sufficient to say, that the cæcum is that part of the large intestine which lies below the ileocæcal valve. Its blood supply comes from above and from the median area of the abdomen, it is, therefore, an organ which has a complete peritoneal investment. The cæcum can, therefore, never be the sliding part of a sliding hernia. It is merely prolapsed into the hernial sac, and can always be reduced with the greatest ease



When, however, it is found in combination with sliding herniæ of the ascending colon and adjoining portions of the small intestine, then its reduction may not be easy. One form of such a hernia is particularly puzzling, so much so, that the French have seen fit to give it a special name "*hernie per bascule*"

The pathogenesis of this hernia is the following. Let us assume a very small sliding hernia of the posterior wall of the ascending colon, at the point where this organ joins the cæcum. In the progress of the hernia more and more of the adjoining portion of the cæcum is being extruded, but a small part still remains within the peritoneal cavity (Fig 7). We have then a small sliding hernia of the lowermost part of the posterior wall of the ascending colon, a small intrahernial part of the cæcum, and a

budge The sac is then incised more widely, and fortunate is both the patient and the surgeon, who even now recognizes that he is dealing with a sliding hernia of the large intestine. The operator who misses this recognition, regards the intestine as adherent, and proceeds to liberate it, he divides the peritoneum on one or the other side of the intestine; soon considerable hemorrhage is encountered, which is interpreted as coming from vascular adhesions. What has really happened is, that the vascular supply of the prolapsed gut is being cut off. After sufficient gut is liberated, a finger is passed into the peritoneal cavity; the continuation of the gut is felt, and is interpreted as the continuation of the adhesions. If the liberation of the intestine is further proceeded with, the lumen of the gut may be entered. The gut is finally reduced in a slipshod manner, and the sac tied off in an equally slipshod manner. If only a small piece of the intestine has been thus deprived of its arterial supply, the anastomotic circulation may be sufficient to restore vitality; if, however, a large piece of the gut has thus been deprived of its arterial supply, or if the ligatures were placed too close to the gut, beyond the last anastomotic arches, gangrene may result, and the patient dies from a perforative peritonitis.

The surgeon who knows proceeds differently. When he finds that there is difficulty in reducing the last piece of intestine, he incises the sac more liberally, inspects this piece of intestine, and finds here and there upon its surface small pieces of fat, which he recognizes as epiploic appendages; further inspection will also reveal to him upon the surface of the gut, at least one longitudinal band; both points absolutely indicative of large intestine. He does not look upon it as an adherent loop of intestine, but correctly diagnosticates it as a sliding hernia of the large intestine and proceeds to treat it as such, in the following manner. The method was first suggested by Hotchkiss (*ANNALS OF SURGERY*, vol 50, page 470) and amplified by Walton (*ANNALS OF SURGERY*, vol 57, page 86).

Assuming that the incision of the sac was properly made in the centre of its anterior surface, the incision is then extended the full length of the sac. Its liberation is proceeded with cautiously; first the spermatic cord is encountered and dissected away, the liberation proceeds further and further (and is quite easy, if it has been started in the proper line of cleavage), until the

a Sliding Herniæ by a "Pushing" Mechanism.—These herniæ are usually of small size. Exposure is usually very easy through the usual hernia incision. A not uncommon description of such an operation is the following. The first thing that strikes the surgeon is, that search as he may for a sac at the usual site, *i e*, toward the inner side of the cord, no sac is found; again and again he repeats this manœuvre, and again and again he fails. At this point he begins to doubt even the diagnosis of a hernia, perhaps the patient now reacts slightly from the anæsthetic, and coughs or vomits, and sure enough he sees a distinct hernial bulging, and so he begins all over again, with the same result. The patient again vomits or strains, and then he notices that the hernia does not come down on the inner side of the cord, but to the outer side and posteriorly. Even at this stage it is fortunate, if he recognizes by this sign, that he is dealing with a sacless sliding hernia. The surgeon who fails to recognize what he is dealing with, sure only of the presence of a hernia, boldly incises what he believes to be the sac, meets hemorrhage, the importance of which he does not appreciate, and to his chagrin, finds himself within the lumen of the gut. This graphic description need not be considered overdrawn, it occurs frequently.

The most important step in the treatment of these herniæ is their recognition. These herniæ are so small, that they can be readily pushed back, with a little blunt dissection, not into the peritoneal cavity, but into the retroperitoneal space. It is not even necessary to open the peritoneum, at most the peritoneum at the inner side of the internal inguinal ring may be incised, in order to verify the correctness of the diagnosis, the small incision can be immediately closed by a purse-string suture.

Deep sutures are passed, care being taken that the gut is held replaced during the process of tying.

b Sliding Hernia by a "Pulling" Mechanism.—In contradistinction to the preceding variety, these herniæ are usually of large size.

A picture of the operation for such a hernia is often the following. Being of large size, the sac is easily found and incised. Various hernial contents are found, but most of them are readily replaced, but there still remains a piece of intestine, which resists all our efforts at reduction. There is more pulling, more strain, and more violence, but this piece of intestine refuses to

LOOPING THE CARDINAL LIGAMENTS IN UTERINE PROLAPSE.*

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THE multiplicity of operative procedures for prolapsus uteri indicates to some extent the uncertainty of opinion as to the essential cause of the condition. Could this be placed upon a completely satisfactory basis, the surgical treatment of uterine prolapse should at once become direct and definite. Assuming, as we obviously must, that the supports of the uterus have in some way been injured to permit of its downward displacement, the surgical treatment should take the form of a complete or approximate restoration of the injured parts to their normal state. If so much be granted, we must, in any attempt to evolve a rational surgical treatment, proceed to discover, if possible, what actually are the supports of the uterus.

A study of the literature of the subject reveals that the pelvic diaphragm is commonly regarded as the principal support of the uterus, and that the ligaments are considered of secondary value as supports of the organ, one writer going to the length of referring to the theory, that the ligaments are the primary supports, as being "antiquated." As opposed to this latter attitude Emmet long ago drew attention to the fact that the pelvic diaphragm might be lacerated up to the bowel without indication of downward displacement of the uterus, even in the presence of strenuous physical work. And I can recall a case in the Perth Hospital in which, in spite of some incontinence of fæces due to an old perineal laceration extending into the sphincter ani, there was not the slightest indication of uterine prolapse, although the patient was accustomed to do a big washing once a week. In this case, too, even

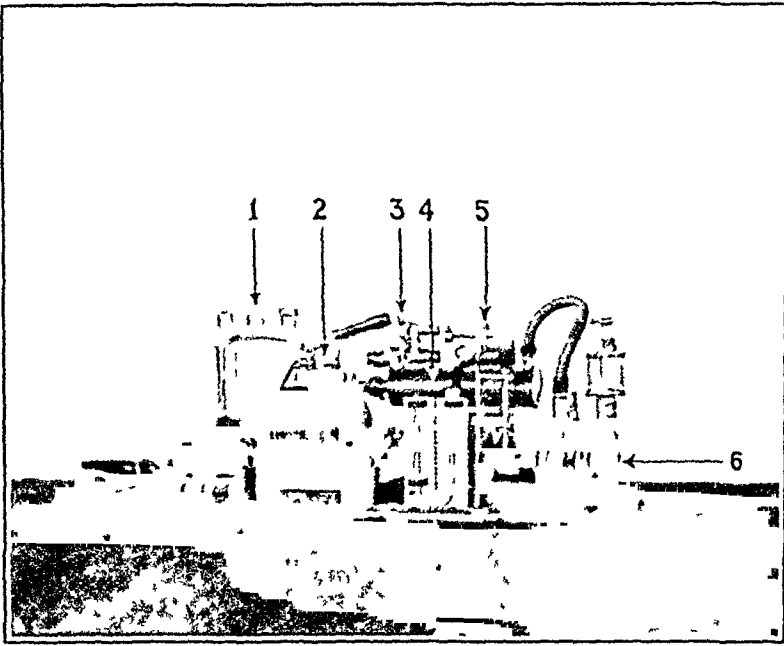
* Read at the Australasian Medical Congress, Auckland, New Zealand, February 13, 1914.

hernial sac, the herniated intestine, plus its blood-vessels, are lifted up from the posterior wall of the hernial space. None of the blood-vessels should ever be injured, if this dissection is properly done. The sac is thus liberated on both sides, but far more freely on the outer side.

The intestine and sac are now held up perpendicularly, when it will be seen, that on both sides of the intestine the sac drops down over the nutrient vessels, the sac is now fastened here and there by an interrupted stitch; when this is done, it is seen that we have made a sort of an artificial mesentery for the intestine. If the liberation of the intestine and vessels has been properly done, there should be no further trouble in reducing the intestine. The remainder of the sac is now closed by a running suture, as a ligation is evidently an impossibility. The radical operation of the hernia is now proceeded with in the usual manner. Throughout the operation it must always be borne in mind that the vessels enter from the mesial side of the gut, particular care is therefore necessary not to injure them.

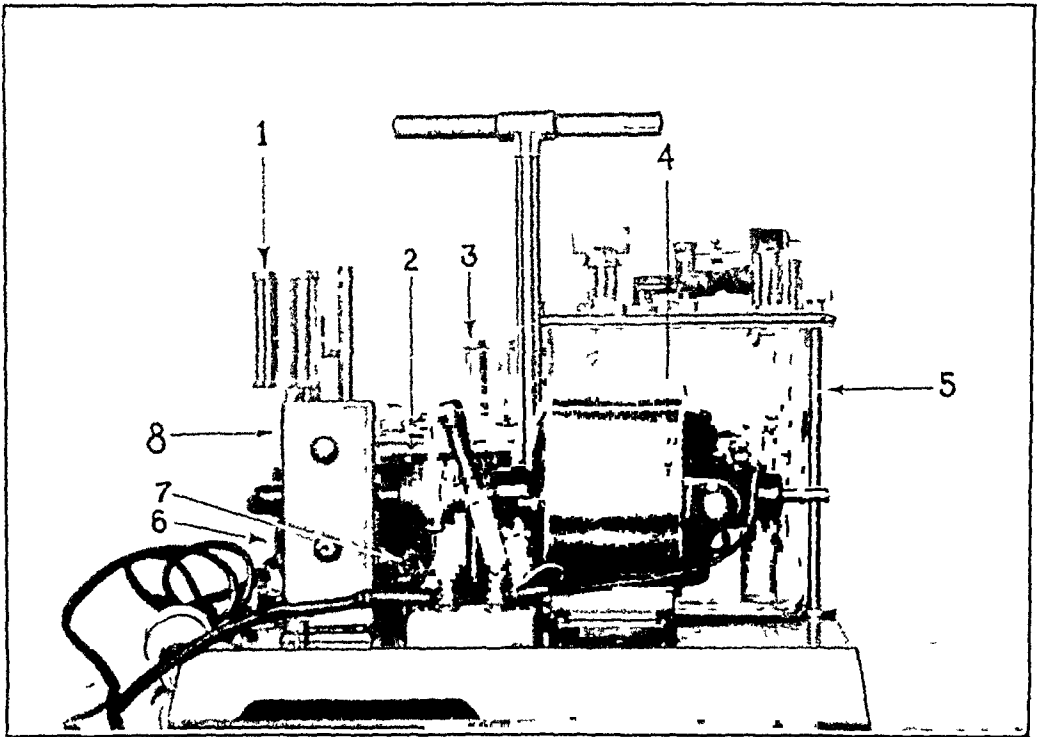
In one case the writer attempted the following procedure for the cure of a sliding hernia, after the diagnosis of a sliding hernia by the "pulling" mechanism had been established. The inguinal incision was temporarily packed with gauze. A separate abdominal incision was made, in the Trendelenburg position the colon was now pulled back into the abdomen, and fastened to the posterior abdominal parietes, by sufficient interrupted stitches of silk (colopexy). After closure of the abdominal incision, the redundant part of the hernial sac was freed and extirpated, and the radical part of the operation finished in the usual manner. The writer has since learned that the Lardonnois had previously suggested a similar procedure.

FIG 1



Smallest apparatus for intratracheal anesthesia measuring $1\frac{1}{2} \times 5 \times 15$ inches and weighing 18 pounds. 1 ether flask, 2 motor, 3, slide valve controlling the percentage of ether administered, 4 air filter, 5, safety valve, 6 blower, 7, manometer

FIG 2



Complete apparatus for intratracheal anesthesia except for means for measuring ether percentages. Weighs 28 pounds and measures 10×14 inches. 1 muffer and air filter to intake of blower, 2, worm wheel which operates the interrupter to the current of air, 3, second air filter between the blower and ether flask, 4, motor, 5, ether flask, 6 and 7, blower, 8, gear box

SIMPLE AND COMPLETE FORMS OF APPARATUS FOR INTRATRACHEAL ANÆSTHESIA.*

BY HENRY H. JANEWAY, M.D.,

OF NEW YORK

(Published from the Department of Experimental Surgery of N Y University and Bellevue Hospital Medical College)

IN the August number of the ANNALS OF SURGERY for 1912, an apparatus for the administration of intratracheal anæsthesia was described for which the advantages of compactness in size and ease of transportation were claimed

Since that time the apparatus has been improved; both its weight and size have been materially diminished. Because of the useful field which intratracheal anæsthesia is destined to fill, improvements of these characters justify a brief description.

Fig 1 represents an apparatus which is fitted with only those parts which are considered necessary for intratracheal anæsthesia. It weighs eighteen pounds and measures $15 \times 4\frac{1}{2} \times 5$. It may be taken apart into three pieces, by removing the pins in the base plate, and can be carried in a small handbag. It is provided with a safety valve and air filter.

Fig 2 illustrates a machine designed for hospital work but easily portable. All the parts are attached to one base plate. In addition to safety valve, air filter, and ether jar, it contains provisions for warming and moistening the current of air and for automatically interrupting the same at desired intervals. It runs noiselessly and measures $14 \times 10 \times 8$ inches and weighs 28 pounds.

Fig 3 illustrates an apparatus containing all the parts mentioned in the description of the machine represented in Fig 2, but in addition, provision for measuring accurately the current of air and percentage of ether vapor. All these parts are fixed upon one base plate. It weighs 35 pounds and measures $19 \times 10 \times 8$ inches. Dr Karl Connell has demonstrated the constancy with which definite ether percentages may be adhered to during anæsthesia. This work has been confirmed by Boothby, of Boston, and the author is convinced of the truth of these claims. Ether may, therefore, be administered with greater scientific accuracy and safety to patients when it is possible to accurately control the percentage given.

In this machine the varying quantities of ether are delivered to the vaporizing jar by a piston which can be set to deliver any desired quantity per minute. The quantity of air is measured by the height to

* Read before the American Association of Anæsthetists, June 18, 1913

This, in turn, means diminished arterial supply with lessened physiologic resistance of the cells undergoing metaplasia. While there may be in addition something more necessary, extrinsic or intrinsic, to initiate the cancer process, this much is always present, a suitable soil, if you please, and would seem enough in itself to cause cancer.

The past month has been a notable one in bacteriology, inasmuch as Noguchi and Flexner, of the Rockefeller Institute, have definitely reported the discovery of the germs causing rabies and infantile paralysis respectively. Cancer may be the next enemy to capitulate, and, if so, let us hope that it will be to either one of these distinguished investigators, or some fellow countryman.

And yet it does not follow that a positive demonstration of the microbic origin of carcinoma will be immediately, or soon, followed by the discovery of a cure. Let us not forget that for more than thirty years the cause of tuberculosis has been known, and yet a remedy for it has not been found. Let us also hold fast to that which is good and known to be effective, early and radical operation, and, keeping constantly before us the unpleasant fact that the cancer menace is an ever-increasing one, in this and every country, threatening, though not so frequently, the young as well as those of middle and maturer years, and the further fact that its diagnosis in the incipient stage is difficult always, and oftentimes impossible, will not our most fruitful results unquestionably be in the direction of preventive rather than curative operations?

SIMPLE AND COMPLETE FORMS OF APPARATUS FOR INTRATRACHEAL ANÆSTHESIA.*

BY HENRY H JANEWAY, M.D.,

OF NEW YORK

(Published from the Department of Experimental Surgery of N Y
University and Bellevue Hospital Medical College)

IN the August number of the ANNALS OF SURGERY for 1912, an apparatus for the administration of intratracheal anæsthesia was described for which the advantages of compactness in size and ease of transportation were claimed

Since that time the apparatus has been improved; both its weight and size have been materially diminished. Because of the useful field which intratracheal anæsthesia is destined to fill, improvements of these characters justify a brief description

Fig 1 represents an apparatus which is fitted with only those parts which are considered necessary for intratracheal anæsthesia. It weighs eighteen pounds and measures $15 \times 4\frac{1}{2} \times 5$. It may be taken apart into three pieces, by removing the pins in the base plate, and can be carried in a small handbag. It is provided with a safety valve and air filter.

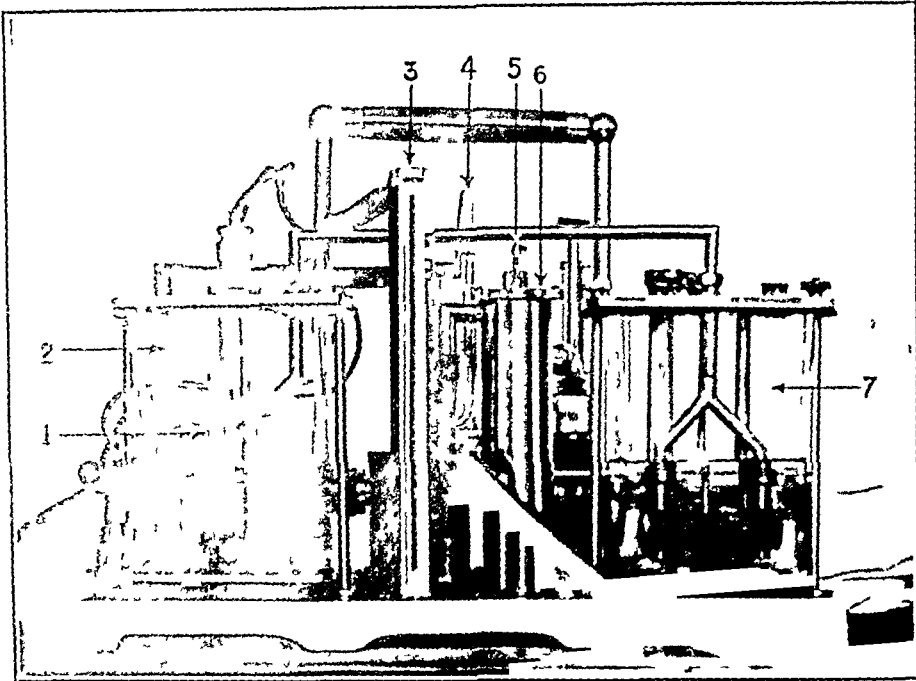
Fig 2 illustrates a machine designed for hospital work but easily portable. All the parts are attached to one base plate. In addition to safety valve, air filter, and ether jar, it contains provisions for warming and moistening the current of air and for automatically interrupting the same at desired intervals. It runs noiselessly and measures $14 \times 10 \times 8$ inches and weighs 28 pounds.

Fig 3 illustrates an apparatus containing all the parts mentioned in the description of the machine represented in Fig 2, but in addition, provision for measuring accurately the current of air and percentage of ether vapor. All these parts are fixed upon one base plate. It weighs 35 pounds and measures $19 \times 10 \times 8$ inches. Dr Karl Connell has demonstrated the constancy with which definite ether percentages may be adhered to during anæsthesia. This work has been confirmed by Boothby, of Boston, and the author is convinced of the truth of these claims. Ether may, therefore, be administered with greater scientific accuracy and safety to patients when it is possible to accurately control the percentage given.

In this machine the varying quantities of ether are delivered to the vaporizing jar by a piston which can be set to deliver any desired quantity per minute. The quantity of air is measured by the height to

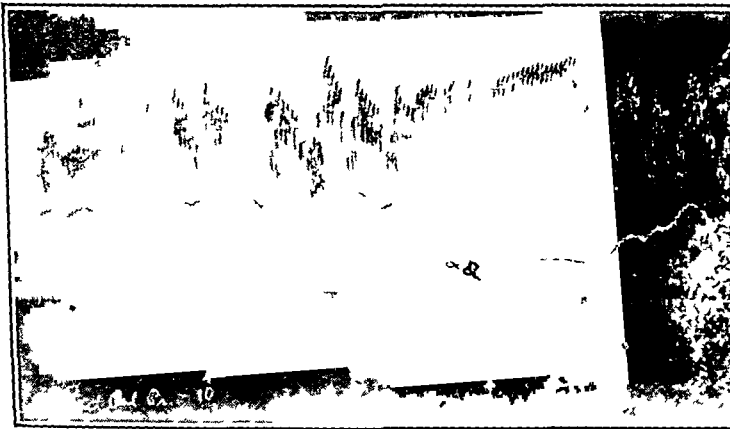
* Read before the American Association of Anæsthetists, June 18, 1913

FIG 3



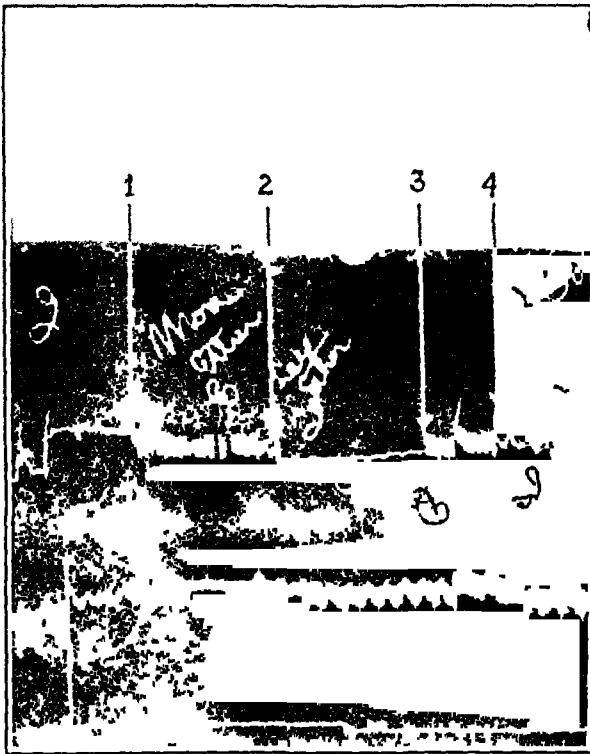
Apparatus for intratracheal anesthesia with provisions for measuring ether percentages. Weighs 35 pounds and measures 19 x 10 x 8 inches. 1 motor seen through the volatilizing flask, 2 volatilizing and warming flask, 3 air meter, 4 manometer, 5 safety valve, 6 air filter, 7 ether flask.

FIG 4



Showing diminution of blood-pressure and output per heartbeat when intrabronchial pressure was raised from 10 to 22 mm. Upper tracing measures the output per beat of the heart. Lower tracing measures the blood-pressure.

FIG 5



Illustrates effect upon respiration when the current of air is interrupted with the thoracic cavity open. Upper tracing the respiration curve, lower tracing the blood-pressure curve between 1 and 2 and between 3 and 4 the current of air was not interrupted

stage of anæsthesia between the excessive respiration occurring when a constant current of air was supplied and the almost entire cessation of efforts at respiration during the periods in which the current of air was regularly interrupted.

The arrangement for automatically interrupting the current of air on these machines, in no way complicates them and is preferable to relying upon the anæsthetist for their production.

It will be noticed that all these machines are open and simple in construction All parts are easily reached

which a float rises within a perpendicular tube, the lumen of which is shaped like a truncated cone. The higher, therefore, that the float rises the larger is the circular space around it and between it and the walls of the tube. This form of meter works accurately and may be tested at any time in the offices of any gas company.

We have tested it by a wet meter purchased for the purpose and have found no variations during a period of several months.

All these machines work on both the alternating and direct current.

When the author first used this machine he was not entirely assured that the administration of ether in known percentages offered a material advantage, especially if the services of an expert anaesthetist should be at hand. In whatever manner ether is administered, the physiological effect upon the patient is the only safe guide to the amount of ether which should be given. While it always is a satisfaction to know the amount of air and the percentage of ether which the air contains, this knowledge can only be obtained at the expense of adding to the apparatus extra parts for this purpose.

Continued use of the machine has convinced the author that a knowledge of both the amount of air and the quantity of ether administered per minute is more than a satisfaction. It prevents, on the one hand, inconveniences amounting sometimes to actual dangers from the use of improper quantities of air and renders possible the administration of ether with far greater accuracy.

The device for mechanically interrupting the current of air is to be viewed in the same light. Regularly interrupting the current of air makes no difference in the blood-pressure, when the current of air is supplied within the pressure limits which are indicated during intratracheal anæsthesia.

It is well to remember that at a high pressure, which sometimes may occur accidentally, the pulmonary circulation can be sufficiently compressed to reduce seriously the output of the heart and the general blood-pressure. This change is illustrated in Fig. 4.

The great benefit from regularly interrupting the current of air is noticed during intrathoracic operation when the thorax has been opened. Fig. 5 illustrates the contrast during the same

At the present time, 23 months after operation, there was flexion to 35 degrees, but extension was limited to 160 degrees, apparently by bony contact. Pronation and supination were complete. There was no pain nor decrease in power. The indications for operation in this case, the speaker said, were the faulty position and complete separation of the fragments.

DR DARRACH'S second case of fracture of the head of the radius was that of a man of thirty-two, who, on February 18, 1913, fell off the lowest step of a ladder, striking on the outer aspect of his left elbow against a concrete floor, the elbow resting against his side. Following the injury there was a moderately sharp pain over this region, and the forearm hung limp. It was bandaged and put in a sling and then put up in plaster for two weeks. After an X-ray was taken, an operation was advised, and the patient was brought to Roosevelt Hospital.

On the seventeenth day after the injury an incision was made over the dorsal aspect of the radiohumeral joint, and an attempt made to replace the loose fragment, which consisted of the outer half of the head, and a small portion of the neck. This was unsuccessful, and it was removed. The wound was then closed, and the arm put up at right angles in a starch bandage. When the bandage was removed and the stitches taken out twelve days later, the wound was firmly united. At this time there was flexion to 85 degrees, extension to 130 degrees, pronation 20 degrees, and supination 60 degrees. A week later there was flexion to 70 degrees, extension to 145 degrees, 60 degrees of pronation and 75 degrees of supination. Eight months after the operation there was flexion to 45 degrees, extension to 165 degrees, with 90 degrees of pronation and supination.

Dr Darrach said it should be possible to replace a single fragment, providing it did not involve too much of the head of the radius and the attempt was made sufficiently early. In this case, which was done on the seventeenth day, there was too much new tissue deposited to allow of accurate apposition.

DR JOHN A. HARTWELL reported the case of a young woman who fell through a plate glass door, striking on her arm and receiving a fracture of the head of the radius, of which the speaker showed an X-ray picture. The injury was first treated by flexing the arm at a right angle and later by partial flexion. At the present time, the patient had good function, with practically complete flexion, but some limitation of extension.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

*Stated Meeting, held at the New York Academy of Medicine,
December 10, 1913.*

The President, DR. FREDERIC KAMMERER, in the Chair

FRACTURE OF THE HEAD OF THE RADIUS.

DR. WILLIAM DARRACH showed two cases, with stereopticon illustrations of the X-ray findings. The first patient was a woman, twenty years old, who, on January 10, 1912, fell, striking on her right elbow. There was sharp pain over the radial head, with greatly impaired function. On the day following the injury, after an attempt at reduction under chloroform, the X-ray showed two loose fragments and an operation was advised. At this time there was great tenderness over the radial head, which was increased by pronation and supination. The head of the bone moved with the shaft. Flexion was limited to 45 degrees, extension to 150, while pronation and supination were slightly limited.

Operation, January 18, 1912: With the elbow flexed to 90 degrees, a curved incision was made over the dorsal aspect of the radiohumeral joint, this was deepened through the external lateral and orbicular ligaments, and the joint was opened. One fragment, which was loose and quite separate from the rest of the bone, was easily removed, but a second piece was dislodged with some difficulty, as it lay deep in the wound. Its removal was accomplished, however, and the wound was then closed with catgut and silk. The first dressing was made on the fifth day, when the stitches were removed. The wound healed primarily, and motion was begun on the tenth day. An X-ray, taken about a fortnight later, showed that a third fragment had been overlooked, but as flexion was then possible to 50 degrees, no attempt was made to remove it.

At the present time, 23 months after operation, there was flexion to 35 degrees, but extension was limited to 160 degrees, apparently by bony contact. Pronation and supination were complete. There was no pain nor decrease in power. The indications for operation in this case, the speaker said, were the faulty position and complete separation of the fragments.

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DR ELLSWORTH ELIOT, speaking of the presence of loose fragments in fractures of this nature, said he did not think they were of any special harm, irrespective of their position, but by becoming attached to some part of the articular surface, they might readily interfere with motion, particularly with extension and possibly with rotation. Two or three years ago he had a case where the X-ray showed multiple small fragments. After opening the joint, he introduced a small Nelaton catheter and washed out the joint with sterile saline solution, and during this process the small particles of bone came away. Some of these were as large as a pea, while others were very small fragments, and could not readily have been removed in any other way. An irrigation of the kind is almost certain to remove them and that too, with the least degree of trauma to the joint structures.

DR. JAMES M HITZROT reported the case of a girl, twenty-six years old, who fell forward, striking on her extended hand. An X-ray was taken, which showed an injury similar to that portrayed in Dr Darrach's first case. Upon opening the joint, he found a fracture through the head of the radius, and of the capitellum, with a fragment of the capitellum engaged in the fracture line. In this case, Dr Hitzrot said, he removed the head of the bone, because he had seen several cases where supination was more or less interfered with when the fragment was left behind. In his own case, of which he showed the specimen, the woman obtained excellent function in spite of the fact that the head and part of the neck of the bone were missing.

DR. DARRACH said they had had in the Out-Patient Department 20 cases of fracture of the head of the radius, during the last three years, which had been treated without operation. Of ten of these, whose X-ray plates had been gone over, five showed a fissured fracture of the head, with slight or no displacement, and the other five showed a fracture of the neck with more or less impaction. The results in these, as far as they had been traced, were satisfactory. Some showed a little limitation of pronation and supination, and many of them showed slight limitation of extension. In cases where there was little or no displacement of the fragments, it was wise, the speaker thought, to try conservative methods.

In addition to the cases shown, Dr Darrach said he had operated on five other injuries to the radial head. One comminuted

fracture of the head, where the whole head and neck was removed, showed perfect supination and pronation, and perfect flexion and extension. In two anterior dislocations of the head, associated with fracture of the ulnar shaft, the head and neck were resected in one case, with complete restoration of motion, while in the other case the dislocation was reduced, after re-fracture of the ulna, by cutting through the orbicular ligament. The remaining two cases were fractures of the radial head associated with posterior dislocation of the ulna at the elbow. The head and neck were removed in both. Pronation and supination were restored, but there was limitation of flexion and extension due to other causes.

When the loose fragment involves a considerable portion of the internal aspect of the radial head, it is wiser, Dr Darrach thought, to remove the whole head and neck. Otherwise, the changes at the superior radio-ulnar joint would materially interfere with pronation and supination.

PYLOROPLASTY FOR GASTRIC ULCER

DR JAMES M HITZROT presented a laborer, twenty-nine years old, who was admitted to the New York Hospital on January 27, 1913, complaining chiefly of a pain in the right upper quadrant of the abdomen. He stated that he had suffered more or less from abdominal pain for the past fourteen years. In October, 1911, he had been operated on for cholelithiasis, and in the following February the abdomen was again opened, when a "wound in the gut" was repaired. Following this second operation he had an attack of vomiting about every three weeks, associated with severe epigastric pain. On July 1, 1912, a gastro-enterostomy and appendectomy was done at the Mayo Clinic, and following this operation the patient had remained perfectly well for three months.

Present History For ten weeks prior to his admission to the New York Hospital the patient had suffered from pain in the right upper quadrant, just below the costal margin. This pain was intermittent in character, and at times was so severe that he had fainted. It radiated through to the back, but never upward to the shoulder blades, and usually came on from half an hour to one hour after taking food.

Examination showed an indefinite mass on deep respiration

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in the right kidney region. There was a small hernial protrusion through a scar of the right rectus, with considerable tenderness over the upper part of the scar. Several blood counts were taken, which showed 100 per cent of hæmoglobin, with 6,000,000 red cells, 15,000 leucocytes, and 64 per cent of polynuclears. The von Piquet test was strongly positive within twenty-four hours.

Operation by Dr Hitzrot, February 4, 1913. A right rectus incision was made above the umbilicus through the old scar, and upon entering the peritoneal cavity, a mass of adhesions was found, especially about the gall-bladder. The pyloric region was freed from adhesions, and upon examining the stomach, the old gastro-enterostomy opening was found to be closed. The pyloric ring was narrowed and indurated, especially anteriorly and on the duodenal side of the pylorus. A typical Finney pyloroplasty was done, and on completing the anastomosis between the stomach and the duodenum, the opening was large enough to easily admit the tips of three fingers. The wound was then closed, a small cigarette drain and two pieces of gauze packing being left in the abdomen for drainage.

The wound healed primarily, and the patient was allowed up on the tenth day. He was discharged on February 15, 1913, and since then had been entirely relieved from pain and other symptoms of gastric disturbance. The diagnosis in this case was chronic ulcer of the stomach.

DR. ELIOT said that recently he had been interested in the radiographic findings of the passage of bismuth through a gastro-enterostomy orifice. From a number of cases which he had studied, including not only those within a month after operation, but also those in which an interval longer than a year had elapsed, the size of the opening seemed to make little difference. In each instance only a very small-sized stream of bismuth found its way through, and he had come to the conclusion that most of the bismuth passed through the pylorus and comparatively little through the gastro-enterostomy orifice.

DR. ARPAD G. GERSTER said he recalled a very important and interesting observation regarding the closure of the gastro-enterostomy orifice that occurred about six years ago in the practice of Dr J. Kaufmann. The patient, Dr Gerster said, came under his care on account of a gastrocolic fistula, as the result of which he was passing formed fæces through his mouth. Several years

THE LOCALIZATION OF FOREIGN BODIES WITHIN THE TISSUES, WITH A DESCRIPTION OF A METHOD OF LOCALIZATION.

BY ALFRED J. BROWN, M.D.,

OF NEW YORK CITY

Adjunct Assistant Attending Surgeon, First Division, Bellevue Hospital, Instructor in Anatomy, Columbia University

OFTENTIMES the search for a small foreign body within the tissues is protracted and fraught with considerable difficulty in spite of the fact that its position may have been accurately determined theoretically by one of the present methods of localization. These methods are rather complex and require careful mathematical calculation and, some of them, special instruments. Consequently a simple clinical means would seem to be desirable.

A review of the methods thus far described for locating accurately foreign bodies within the tissues of the body allows them to be divided into two classes: 1. The localizing of the foreign body, if metallic, by the electric searcher, and 2, localization by stereoscopic radiography.

1 *Localization by the Electric Searcher*—The metallic electric probe has been in use for many years but it is of value only in cases in which there is an open tract leading down to the foreign body. As a result the instrument is useful chiefly in gunshot wounds.

Thomas,¹ for locating metallic foreign bodies, makes use of a telephonic searcher. This consists of three needles mounted on a handle and so wired that contact of any two of the needles with a metallic object completes an electric circuit and rings a bell. The instrument is advocated as an aid in operation and is used after an incision has been made through the skin. The needles are thrust into the tissue in various directions until the foreign body is encountered. Immediately upon touching the foreign body the bell rings, the sound being

On December 4, 1913, Dr. Hitzrot removed the tumor on the right side of the neck, which was giving rise to pain. Its removal was accomplished with some difficulty, because of the presence of dense, fibrous adhesions.

Dr. Hitzrot said there was no history of alcoholism in this case, and there were no physical signs of any tuberculous process in the lungs.

DR CHARLES A. ELSBERG said that four or five years ago Dr. John F. Erdmann showed a case of multiple symmetrical lipomata, and three or four months prior to that time the speaker said he had presented a similar case, shortly after Marie had described the condition of symmetrical adenolipomatosis. Marie contended that these lipomatous growths contained adenoid tissue, that the condition was usually met with in alcoholics and that the patients were apt to succumb to tuberculosis. In his own case, Dr. Elsberg said, the patient died three or four years later of pulmonary tuberculosis.

DR OTTO G. T. KILIANI said that at one of the meetings of the Society at the German Hospital, he showed a case of symmetrical lipomatosis involving the arms and abdomen, and the case was subsequently published, with a photograph, in his book on Surgical Diagnosis. In that case he removed one of the large tumors, and when he last saw the patient, about six months ago—perhaps eleven years after the operation—he found that a number of the smaller growths that had been left had greatly increased in size. The patient was otherwise in good health and showed no evidence of any pulmonary trouble.

PERFORATING TYPHOID ULCER

DR OTTO G. T. KILIANI presented a young man who was admitted to the German Hospital on October 6, 1913, with the history that he had been feeling ill for two weeks. During this period he had suffered from cough and frequent vomiting, followed by abdominal pain, diarrhoea, chills and fever. He had remained at work.

On admission, the patient complained of pain and tenderness under the left costal margin, and of great weakness. The lungs gave evidence of a diffuse bronchitis. The abdomen was soft, and slightly distended, with some tenderness in the appendicular region and numerous "rose spots." The spleen was enlarged.

prior to that time he had had an ulcer of the pylorus, for which a gastro-enterostomy was done by Dr F Lange. Dr. Lange followed the usual method of those days, also doing an entero-enterostomy—the Y-shaped operation first practised by the French surgeon Roux.

Dr Gerster said that when he came to operate on this patient, he found that the entero-enterostomy, so far as the adhesions between the two segments of the small intestine were concerned, still persisted, but the communication between them had been obliterated. The site of the gastro-enterostomy, however, could not be located. The openings in stomach and jejunum had not only been obliterated, but the adhesion between the stomach and small intestine had been entirely resolved and abolished. The pylorus had resumed the normal shape, so that the finger could be invaginated through the pylorus into the duodenum. This, the speaker said, was the usual course of events, and as soon as it took place, the gastro-enterostomy orifice closed. If the ulcer recurred, as it was very apt to do, because the operation did not obliterate the patient's vice to re-form ulcers, then we had to deal with a renewal of all the symptoms. As long as there was irritation, adhesions would form, and with the cessation of irritation, adhesions would have a tendency to be abolished and the normal conditions to be re-established.

MULTIPLE LIPOMATA.

DR HITZROT presented an Italian, forty-three years old, who was admitted to the New York Hospital on December 1, 1913, with the history that about three years ago he first noticed several small, soft masses on his shoulders and the back of his head. These increased rapidly in size and during the past six months one of the tumors on the back of his neck had become painful. Eight months ago, two similar growths appeared on the anterior abdominal wall.

Examination showed multiple tumors of varying size over the body and extremities. These were lying underneath the skin, soft, globulated and painless. There was a mass, the size of a lemon, on each side of the posterior surface of the arms between the elbow and shoulder. A small tumor could also be felt beneath the right mammary gland, and similar masses were found on the anterior abdominal wall, on both thighs, over the clavicle and the surface of the forearms.

with chromic sutures, the deeper row being mattress sutures which included peritoneum and rectus muscle. A rubber tissue drain was inserted down to the rectus muscle in the lower angle of the wound. On the third day smears from the pus in the bottom of the glass drain did not show the presence of any bacteria. After a few days the abdominal incision broke open, a loop of adherent intestine presenting prominently in the interval. This piece of bowel was gradually reduced into the abdominal cavity and the skin edges finally drawn closely together by strapping the wound with adhesive plaster.

Regarding peritoneal drainage Dr. Lusk said that Petroff, of Warschau (*Zentralbl f Chir*, No 31, 1913, p 1215), by experiments on 37 rabbits had demonstrated that the removal of fluid from the peritoneal cavity was most effectually accomplished by means of glass drains with wicks, since a drain of this sort stimulated the formation of hardly any adhesions and would continue to abstract fluid out of the general peritoneal cavity for more than 48 hours, while gauze was effectual to drain for only 5 to 6 hours. He also said he regarded that the recovery of this case was due not entirely to an early diagnosis having been made, the patient having been operated upon just 3 hours after the occurrence of the perforation, but in large measure as well to the fact that the patient had been fed with the high caloric diet originated by Dr. Warren Coleman (*Am J Med Soc*, January, 1912) as a therapeutic measure in the treatment of typhoid fever. Thus, this patient instead of coming to operation for an acute peritonitis, emaciated and delirious as was usual under the former methods of treatment, was very well nourished, in a normal state of mind, and consequently in a favorable condition to resist the ordeal necessitated by his complication. The patient suffered no shock from his operation and except for the suppuration and opening up of the wound, recovery was uneventful.

DR. KILIANI rejoined that in most of the cases of operation for perforated typhoid ulcer which had come under his observation where the wound had been closed without drainage, the sutures had subsequently given way. He had no explanation to offer why this was so, but he had an impression that if the sutures had not given way in these cases, a fatal issue would have been more apt to occur. He recalled another case reported to the Society, 1906, where there were two perforations of the ileum

The temperature, on admission, was 104.5° . Three days later it rose to 106.5° and then suddenly dropped to 97° . Accompanying this the pulse was weak, but low, and the patient complained of a fairly acute pain on the right side of the abdomen, below the navel. There was slight rigidity of the right rectus, together with exquisite tenderness in the right lower quadrant.

The case was recognized as one of perforating typhoid ulcer, and when Dr Kiliani opened the abdomen through the outer edge of the right rectus, he found four or five intestinal ulcers, one of which had perforated, while the others appeared ready to perforate. He thereupon resected the appendix and used its mesenterium to cover the perforation of gut. He then simply washed out the abdomen and closed the wound, without drainage.

Following the operation, the patient's temperature again rose to 105.5° , and the case ran an uneventful typhoid course for four days, when symptoms of retention developed, with a sudden drop in temperature and evidences of a second collapse. Upon investigation it was found that the abdominal wound had broken down and showed evidences of infection. The wound was cleansed and permitted to remain open, and from that time on, with the exception of two relapses, the typhoid fever ran its usual course and the patient's further recovery was uneventful. He now had a large hernia, however, at the site of his abdominal wound.

In connection with these cases, Dr Kiliani said, the question arose whether to drain or not to drain. The chief objection to drainage was that we left a foreign body in contact with the inflamed gut and were thus apt to produce further perforations.

DR WILLIAM C LUSK said that he had recently operated upon a case of typhoid perforation, who recovered, at Bellevue Hospital in the service of Dr T A Smith. Through the Kammerer incision he had closed the perforation, which was situated about five inches from the ileocaecal valve, using one continuous stitch of No. 0 chromic gut to bring together the edges of the perforation, and two outer rows of Pagenstecher linen thread inverting the first stitch line. Seropus which was found on the right side and in the pelvic cavity was removed with the Kenyon and Pool aspirating nozzle (*Surg, Gyn and Obstets*, December, 1909). A glass drainage tube was placed in the pelvic cavity through a suprapubic stab wound, and a gauze strip introduced within it. The deep transrectus wound was closed in two tiers.

perfectly clear. Splitting the sac longitudinally he apportioned two leaves, to form a new mesentery for the colon, pushed the colon well into the abdomen, and anchored it there. The mouth of the sac was then closed with purse-string suture, and the inguinal canal repaired in the usual way.

DR. L. W. HOICHIKISS said he had seen a number of these cases of "sliding hernia" at Bellevue Hospital and elsewhere. The patients were usually adults, past middle life, with a moderate-sized hernia which it was very difficult to control with a truss. In the first case he saw, the hernia involved the descending colon and the sigmoid flexure. Operating by the method then devised to meet the emergency, and which he has described, he found that the contents of the sac were easily replaceable *ie*, by splitting the sac well down in front he formed a sort of mesentery which allowed the gut to be replaced without injury and then the rest of the opening was closed by purse-string suture in the usual manner. Subsequent to that he encountered several of these cases in succession, and the operation he had devised gave admirable results in dealing with these cases, the smaller sliding herniæ of the right side as well as the large sliding variety on the left side.

DR. BURTON J. LEE said that about three years ago he saw a case of "sliding hernia" on the right side, and on operation it was found to include the ascending colon. The case resulted fatally from acute intestinal obstruction and peritonitis. In this case, the speaker said, the fatal result had been due to a replacement of the bowel directly inward, rather than upward and outward behind the peritoneum.

DR. WILLIAM B. COLEY said he had been much interested in the subject of "sliding hernia" for many years, and a large number of these cases had come under his observation at the Hospital for the Ruptured and Crippled and at the General Memorial Hospital. He did not quite understand why Dr. Moschowitz advanced such an arbitrary rule in regard to the pathogenesis of the condition, as it was at variance from that long held by other men and with his own experience.

Dr. Coley said that in spite of theoretical objections regarding its etiology, we must recognize that this form of hernia, sliding hernia of the cæcum, does occur. Personally, he was inclined to believe that it was the result of a congenital malformation, and

and one of the gall-bladder. The man was apparently progressing favorably after the operation, but he succumbed on the tenth day from pneumonia.

Dr Killian said he had seen the statement that 25 per cent of these cases were saved by operation. These figures seemed to him rather high, unless we took into consideration the fact that the favorable cases were more likely to be put on record than those that had resulted unfavorably.

Dr CLARENCE A. McWILLIAMS said they had had 20 cases of perforated typhoid ulcers at the Presbyterian Hospital up to three years ago, with five recoveries after operation—25 per cent

HERNIA OF THE LARGE INTESTINE, WITH SPECIAL REFERENCE TO "SLIDING HERNIA."

Dr A. V. MOSCHCOWITZ presented a paper with the above title, for which see page 610.

Dr ARTHUR S. VOSBURGH said the paper of Dr Moschcowitz and his diagrams of sliding hernia were a great help to the clear understanding of this subject. When a year or so ago he read Dr Hotchkiss's paper on the treatment of sliding hernia, he was unable to follow clearly the steps there described in the treatment of the sac. Not until he had a case of sliding hernia of the ascending colon, and had attempted to describe to the house surgeon the method of repair, had he fully appreciated the difficulties of a written description.

In a recent case, that of a very old man, operated under novocaine, he came down upon tissue that did not seem to belong to a hernial sac. Incision of this tissue excited free bleeding, and further attempts to enter the sac at this point were abandoned. The peritoneal cavity was entered in the neighborhood of the internal ring, and then the explanation of the condition was clear. A sliding hernia of the ascending colon, the tissue that bled freely on incision, was the non-peritoneal surface of the ascending colon, being covered by the lymphatics and blood-vessels that supply the ascending colon. On inspecting the neck of the sac, it was found that the ascending colon occupied two-fifths of the ring. If approach to the sac from this side had been persisted in, the lumen of the gut would have been entered, and much damage to the blood supply of the colon would have resulted. Recalling Dr Hotchkiss's paper, his description of the treatment of the sac was then

BOOK REVIEW

SURGERY OF THE EYE By EDWIN TOROK, M. D., and GERALD H. GROUT, M. D., p 485 Lea & Febiger, Philadelphia

The plan of this book as outlined in preface, namely, the disease, the selection of operation, detailed steps of operation, list of instruments required, complications and first operative care, is followed closely and admirably carried through the book.

The first part, covering 120 pages, deals with general surgical methods. In twelve pages the post-operative complications are ably and concisely discussed

Pages 65 to 121 are devoted to a systematic description of instruments and their uses and contain valuable hints to beginners

Part II is prefaced by eight pages on the surgical anatomy of the eyeball and in the remaining 337 pages the operations on the eyeball and appendage are taken up in logical sequence

The book finishes with a chapter of sixteen pages on removal of foreign bodies

Among the more recent operations and those not described in detail in the current surgical text-books are Legrange's sclerectomy and sclerecto-iridectomy, Heine's cyclodialysis, Elliot's trephining of sclera, Toti's operation on nasal duct. The technic in use of Schiotz tonometer, and the technic of keratoplasty

This book is well written, compact and yet as comprehensive as was possible in 400 pages. It may not give quite the personal touch or impart the individual experience noticeable in some edited in recent years but the selection of operation and methods are well chosen and painstakingly described. The description of the more modern operations will be appreciated

One excellent feature of the book is its wealth of original illustrations which, together with the concise and lucid text, can hardly fail to impart to the beginner a good understanding of the operation in question. Altogether this volume is a distinct contribution to the existing books on ophthalmic surgery

P CHALMERS JAMESON.

that, while the cæcum may be covered by mesentery, in certain cases it was not.

Finsterer (*Beitr. z. klin. Chir.*, November, 1912, Bd 81, p 198) recently reported three cases of sliding hernia, two of which were of the cæcum. Hilgenreimer in his statistics, comprising 2238 cases, reported 8 cases in which the cæcum formed part of the sac.

At the Hospital for Ruptured and Crippled, up to December, 1912, the sigmoid was found in the sac 5 times, the cæcum alone in 7 (these cases were of the sliding variety), the appendix alone was found in 15 cases.

As to the operative treatment of sliding herniæ, the speaker thought the method advocated by Dr Moschcowitz was a very excellent one and was similar to that described by Dr Hotchkiss. Dr Coley stated that in certain difficult cases, he believed that the procedure described some years ago by Fiaschi, of Sydney, Australia, in which the cæcum or sigmoid, after reduction, is fastened by suture to the anterior abdominal wall, was a good one, in ordinary cases, he had not found it necessary.

DR MOSHCOWITZ, in closing, said that while with the ordinary variety of "sliding hernia" the descending and ascending colon only were involved, even the small intestine might be involved, and he recalled one case of Dr Gerster's where there was a "sliding hernia" of small intestine. We could imagine a very large hernia on the left side with the entire mesosigmoid unfolded, then we would have a "sliding hernia" of the sigmoid flexure, but not until then. A "sliding hernia" of the bladder was very common, and the speaker said he had seen a "sliding hernia" of the uterus, but the common variety was that of the ascending or descending colon and not of the sigmoid flexure.

area thus painted should include one-half the circumference of the part. As an example, in the knee the first vertical line should run along the antero-internal margin of the knee and the last along the postero-external. The horizontal lines should connect the vertical. If the entire circumference is laid out in squares, the lines of one-half the circumference should be solid and those of the other half dotted. The reason for this will be apparent. The silver solution is allowed to turn black and the skin thus stained. The lines are then painted over with white lead paint and this allowed to dry. Two radiographs are now taken, one, anteroposteriorly and one, laterally, the target of the tube being placed directly over the position of the foreign body as shown in the preliminary skiagraph. The resulting skiagraphs show the shadow of the foreign body with relation to the squares painted upon the skin. By projecting imaginary lines from the shadow of the body in the two positions with relation to the overlying lines, its approximate depth from the surface is easily calculated. If the entire circumference of the part has been painted, the position of the body is noted accurately by projecting the point of intersection of the shadow with the solid line on one surface to its point of intersection with the dotted line on the opposite surface. If desired, a tracing of the lines and the shadow of the body may be made on a transparent paper and this tracing laid upon the skin so that the lines of the squares correspond accurately. The shadow of the foreign body may then be marked upon the skin with silver nitrate to be used as a guide at operation. Following the radiographic examination the white lead is removed and the part placed at rest until operation.

This method has been employed in three instances in the First Surgical Division of Bellevue Hospital, New York City, in the services of Drs. John B. Walker and Lucius W. Hotchkiss, to whom I am indebted for the privilege of making this report.

In each case the foreign body (a needle) had moved a considerable distance from its point of entrance and in none of the cases could it be palpated.

CASE I—*Needle in the knee* (Figs. 2 and 3). One month before admission the child fell, driving a needle into her knee. The knee is held in flexion of 160° and extension is painful. After radiographic localization an attempt to remove the foreign body by operation was made and after a search of fifty minutes

INTERNATIONAL SURGICAL ASSOCIATION.

THE Fourth Congress of this Association will be held at the Hotel Astor in New York City lasting four days, beginning Monday April 13, 1914. This is the first time that the Congress has ever had a meeting outside of the City of Brussels, where the first one was held in 1905 and repeated every three years. The membership of the Association is limited to a certain number from each country. The membership in the United States is about one hundred. The President of the Fourth Congress is Professor Depage of Brussels, Professor Willems of Ghent is President of the International Committee, and Dr. L. Mayer of Brussels is the General Secretary.

The programme is limited to consideration of three main topics.

First, Gastric and Duodenal Ulcers. Introduced by papers by De Quervain of Basel, Hartmann of Paris, Lecene of Paris, Mayo of Rochester, Minn., Moynihan of Leeds, Payr of Königsberg.

Second, Grafts and Transplantations. Introduced by papers by Morestin of Paris, Villard of Lyons, Ulmann of Vienna, Lexer of Jena, and Carrel of New York.

Third, Amputations. Introduced by papers by Witzel of Düsseldorf, Ceci of Pisa, Kuzmík of Budapest, Binnie of Kansas City, Durand of Lyons, and Ranzi of Vienna.

After the close of the Congress, Thursday, April 16, most of the foreign members will make a tour of other cities, the itinerary including Philadelphia, Baltimore, Washington, Chicago, Rochester, Minn., Montreal, and Boston.

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is emptied as best possible out of the two limbs, in order to avoid any error in interpretation later on. A hæmostatic band is then applied at the roots of both limbs, which should be allowed to remain sufficiently long to produce anæmia of the tissues. The elastic bands are then simultaneously removed on both sides, and the observer follows the redness which extends from above downward on each extremity, at the same time noting the rapidity, the degree of color, and the point at which it stops.

These various stages of Moszkowicz's sign can be interpreted in several ways, and for this very reason it is essential to consider their execution in detail. The patient is placed in the dorsal decubitus and the venous blood is then expelled in various ways from the members to be examined. The simplest way is vertical elevation of the limb, as by gravity the column of venous blood makes its exit, but in order that the emptying shall be thorough this position must be maintained sufficiently long in order to avoid the return of the venous blood after arterial hæmostasis. In point of fact, in these cases the limb, instead of taking on the livid hue of nonvascularized tissues, assumes a violet tint which becomes confounded with the redness following the removal of the hæmostatic band. Here is a cause of mistake that must be eliminated at any cost, above all in the first trials made. Afterwards, from habit, it will be an easier matter to interpret the experiment, in spite of the cyanosis due to venous stasis.

In normal limbs, when the hæmostatic band is removed, there is a rapid regression of the violet hue which leaves the tissues decolorized after it. This paleness, succeeding the cyanosis and preceding the cutaneous hyperæmia, is to be interpreted in part like the latter, its rapidity and stopping point are the same as for the redness. Alone the tint does not vary. However this may be, the interpretation of these facts can only be arrived at when *both* limbs are cyanotic, a condition which is not usually met with. Consequently, it is better to avoid venous stasis with all the means at our disposal.

Many patients suffer intolerable pain when the diseased

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ORIGINAL MEMOIRS.

THE TECHNIC OF COMPARATIVE HYPERÆMIA (MOSZKOWICZ'S SIGN)

BY CHARLES GREENE CUMSTON, M D.,

OF GENEVA, SWITZERLAND

Privat-docent at the Faculty of Medicine

It is certain that as yet a definitive diagnostic value cannot be put upon comparative hyperæmia (Moszkowicz's sign), but it is still another means, and undoubtedly a most important one, placed at the disposal of the surgeon in estimating the proper point of amputation in cases of gangrene of the limbs. Nevertheless, the arterial pulsations should be sought for, the local temperature and cutaneous sensibility noted. When the hyperæmia is *perfectly distinct in its limits* it may be said that then the proper site of the amputation is absolutely indicated.

The object of the present paper is to indicate as clearly as possible the proper technic to be employed in the search for Moszkowicz's sign in order to avoid certain errors which might otherwise occur, and at the start it will be taken for granted that the reader is familiar with the principles upon which this diagnostic sign is based. The experiment consists in applying a rubber band at the root of the limb presenting gangrene, likewise one on the healthy mate, and then comparing on both limbs the rapidity and degree of color of the cutaneous hyperæmia following the removal of the constricting bands.

In principle, one proceeds as follows. The venous blood

very painful, even in normal limbs, when too long continued, and in a subject with gangrene it often sets up, from the commencement, severe pain in the diseased member. The pain is localized only in the portion involved by the pathologic process, commencing soon after the application of the band and ceasing only after the latter has been removed. The character of the pain varies, but generally it is of the intolerable shooting type, occasionally the patient will only be aware of a dead sensation or tingling localized in the gangrenous parts. When the band is removed the pain disappears and the patient experiences an agreeable sensation of warmth in the entire limb, and particularly in the part where the pain was severest. When the pain has been unbearable, I have resorted to somnoform, which has given the necessary relief without a profound narcosis.

The hæmostasis should be maintained for at least five or six minutes, when the anæmia will be sufficiently marked to contrast well with the hyperæmic redness. When the hæmostatic bands are removed great care must be taken that this be done simultaneously on both the diseased and healthy side. This is absolutely essential in order to estimate the rapidity of the hyperæmic wave and to compare it with the healthy side. As soon as the bands are removed both limbs are placed on the bed in the horizontal position. If the condition of the patient is such as to permit of being raised up, the reading of the sign may be done in the vertical position and this is advantageous, inasmuch as the progress of the flush can be observed on all aspects of the limb. But if the vertical position cannot be assumed without delay it must not be resorted to, as otherwise the wave of blood would be lost to the observer. In the upper extremities the horizontal position is also advantageous, because, if the arms are allowed to hang down the redness descends too quickly and the requisite details of the test are lost.

The best possible light is also very essential. This detail is far from useless, particularly in doubtful cases in which the hyperæmia is pale, or when there is partial arterial occlusion.

lower limb is maintained in a vertical elevation, and therefore it is important to prolong this position as little as possible. Instead of allowing the venous blood to flow out by gravity, this may be hastened by massage directed toward the root of the member. An excellent means is to apply an elastic bandage, starting from the distal end and bringing it up to the upper part of the thigh, thus following the direction of the venous flow. This procedure, currently employed in operations for avoiding venous stasis, has the advantage of emptying with the greatest force the limb to be operated on. But a shadow dims this procedure, for it is to be feared that in cases of embolus a clot which has not become organized may become detached. However, it can be said that in the cases here considered, I am unaware that this accident has ever been recorded, and personally I have never had any disturbance of this kind in the few cases where I have employed it.

Arterial hæmostasis should be made as high up as possible at the root of the limb—at the axilla in the case of the arm, at the groin for the lower extremity. It is preferable to employ a rubber band or tube. Esmarch's tube is the one that produces the greatest degree of anæmia on account of its great compressive power, but in one case recorded by Mendelsohn it was powerless to compress the femoral artery on account of the rigidity of the walls of the vessel due to sclerosis. Some operators refuse to use it in cases of atheromatous gangrene, fearing that it might break the brittle vascular walls, but in cases in which it has been employed for Moszkowicz's sign it has given rise to no trouble. Personally I have never used it, simply because I preferred the flat band, which does not cut into the flesh so much and still produces quite sufficient anæmia for the production of the phenomena searched for. *Always bear in mind that a cyanosis subsisting in a limb after hæmostasis is applied may be due to an insufficient compression.*

The question of the duration of the hæmostasis is also important. The band should be left on long enough for the hyperæmia, following its removal, to be very marked, so as to give a distinct redness. However, the constriction becomes

red it changes to a pale pink hue which gradually blends with the colorless anæmic integuments of the diseased portion

It has been said that in some cases both blood waves descend with the same intensity and rapidity up to the point of disease where the wave suddenly stops. But in practice it is not always so, for there may be a certain delay on the diseased side in the appearance of the cutaneous hyperæmia, the healthy side being already almost entirely covered when the phenomenon takes place in the mate. In this case it slowly descends to a certain point on the diseased limb, where it stops more or less suddenly. This slow progress of the hyperæmic wave generally is met with in the pale type.

To the third type, mentioned above in reference to the color, may be added a change in the quickness of the progress of the wave. At first there is a simultaneous departure and equal rapidity of the wave, then the rapidity decreases (in the diseased limb) at a distinct point where the dark red color suddenly stops. Here the pale area, of which we have spoken, progresses slowly.

An important point, often difficult to appreciate, is the estimation of the point where the hyperæmia stops or also the point where the color and rapidity of the waves change in character. In principle, this point varies according to the site of the arterial obliteration, but Moszkowicz considers that it corresponds exactly with the level of the occlusion.

According to the case, the cessation of the hyperæmic wave takes place suddenly on the diseased side in a transversal line. In other instances the level will be different on the external and internal aspects of the limb. Then, again, an area on the member may remain completely pale while the rest is more or less colored by the flush. This occurs more especially in the lower extremities. For example, the external aspect of the leg may remain perfectly pale, while there is hyperæmia of the posterior cutaneous surface.

Such are the conditions met with in practice. At present it seems to me that the diagnostic value of comparative hyperæmia should be limited to cases of gangrene due to vas-

or an imperfect arterial hæmostasis. Too much light, on the other hand, is not to be desired as it might blind the eye of the observer. It is better to turn the back to the light, for then there is no reflection and one can distinctly estimate the degree of redness following the removal of the bands. This stage of the examination, which is the *reading* of Moszkowicz's sign, is the most important.

As has been said, the integuments must have been prepared so as to offer a livid paleness. When the expression of the venous blood has been improperly done, when the arterial compression has been insufficient, a violet line results which greatly hinders the experiment.

As soon as the bands are removed a uniform, dark red blush normally invades both limbs from the point of compression to the tips. This blush progresses with the same rapidity on both sides, upon the express condition that the constriction is removed simultaneously. When there is arterial occlusion on one side the characters of the hyperæmic wave are changed, and it is upon this difference in the character of the diseased limb, compared with that of the healthy one, that the interpretation of the experiment is based.

There are three phenomena which vary in the hyperæmic wave in a limb the seat of arterial occlusion, namely, the rapidity of the wave, the intensity of its color, and its stopping point. In some instances both red bands progress with equal rapidity in the direction of the arterial flow, the only difference being that in the diseased limb there is a sudden cessation of the hyperæmic wave at the level of the vascular obliteration. In other cases the hyperæmia is very much paler on the diseased side and progressively fades from above downward, becoming blended at a point, difficult to distinctly recognize, with the paleness of the non-vascularized integuments. Between these two extremes there is a mean term, in the distribution of the hyperæmia.

When the constriction is removed the hyperæmia covers both limbs with the same intensity up to a certain point, and on the diseased side it suddenly changes in aspect, from a dark

VACCINE AND SERUM THERAPY IN SEPTICÆMIA

A CLINICAL STUDY OF THE COURSE AND TREATMENT OF 111 CASES

BY A CAMPBELL BURNHAM, M D,

OF NEW YORK CITY

THE advances in bacteriology and biologic therapy have been so great during recent years that an inquiry into the results of the modern treatment of severe general infections, in which a condition of bacteraemia is presumably present, needs no further justification

One hundred and eleven consecutive cases of severe infection have been collected from the records of the Presbyterian Hospital, New York City, in which either the course and symptoms were those of septicæmia, or cultures showed the presence of bacteria in the circulating blood. These cases occurred between 1905 and 1913 and represent, not the therapy of one physician, but rather, the treatment of a group of physicians and surgeons on the various services of a general hospital. Moreover, during this period the recognized methods of treatment have, in themselves, undergone considerable change. During the earlier part of this period vaccines were never used, and serum only rarely, in the treatment of these general infections, and it was not until 1907 that the facilities of the hospital permitted systematic open-air treatment of ward cases.

The diagnosis of septicæmia is a loose one, many cases are often so diagnosed because of a continued fever of several days, or because of a high temperature associated with a localized infection. A few cases during this period have been excluded because of insufficient data on which to make the diagnosis, and throughout the paper the importance of a positive blood culture is emphasized. Cases in which the blood culture was not made, or showed no growth, have been included because, from a clinical stand-point, they resembled the cases of proved bacteraemia.

cular occlusion, and in these cases the lower limit of the hyperæmic wave represents the point below which the tissues are no longer nourished. Although the sign of comparative hyperæmia quite nearly coincides with the level of the arterial occlusion in the leg, the same cannot be said when dealing with the thigh, because here it indicates the degree of the collateral circulation. It is, however, of all the clinical signs, the surest guide to the diagnosis of the point of amputation in cases of gangrene. This should be done quite a little above the lower limit of the hyperæmic area, even if one is obliged to sacrifice a certain amount of vascularized tissue.

culture Two cases were due to the bacillus aerogenes capsulatus, two were due to staphylococci and the remainder were streptococcic bacteriæmia

In Western's¹ 39 cases, 36 showed streptococci, 2 staphylococci and 1 an unidentified coccus The comparison between cases with positive blood cultures in this series and Western's, a total of 146 cases, is shown below

Western (96 cases)	Blood culture		Recovered	Died	Result unknown
	positive				
Streptococci	36	10	26	0	
Staphylococci	2	1	1	0	
Present series (50 cases)					
Streptococci	18	7	10	1	
Staphylococci	2	2	0	0	
B aërog caps	2	0	2	0	
	—	—	—	—	
Totals (146 cases)	60	20	39	1	

Positive blood cultures then, in puerperal septicæmia, mean a mortality of about 66 per cent, and I have found no records of an extended series of cases in which the mortality of this type of cases was much less than this These figures will be referred to later in reference to treatment

The leucocyte count was made in nearly every case, often daily during the febrile stage of the disease It was generally between 10,000 and 20,000 The count on admission has been studied as to its possible diagnostic or prognostic indications The average admission count of 18 fatal cases was 19,000, and, of 18 cured cases, it was 14,900 This would apparently indicate that a high blood count is of bad prognostic significance However, further study shows that the matter is not quite so simple There were 9 counts of 10,000, or below, and of these 4 died and 5 recovered, there were nine admission counts of 25,000, or above, and of these 5 died and 4 recovered However, it may be definitely stated that a high leucocyte count generally indicates a complication Of the nine cases in which the leucocytes were 25,000 or over, this high count indicated a complication in eight cases, and in the

The cases are divided for purposes of study into five groups. Such a division is an arbitrary one, many cases might have been included equally well in either of two groups, but, in general, the cases fell naturally into a classification based upon the apparent cause or associated lesion which gave a particular characteristic to the picture of a generalized blood infection. The five classes are as follows:

- 1 Cases following abortion and labor
- 2 Cases following infected wounds and abscesses
- 3 Cases associated with osteomyelitis and arthritis.
- 4 Cases associated with malignant endocarditis
- 5 Miscellaneous cases

The mortality of the entire series (111 cases) was 74, or 66.6 per cent. This high mortality should be taken as an index of the class of cases treated rather than a criterion of the methods of treatment. Cases admitted to the hospital wards are often those in which treatment outside the hospital has failed. They are brought to the hospital after treatment at home has failed to alleviate the symptoms, and because the patients are rapidly growing more feeble. In some hospitals the mortality from septicæmia is given as low as 20 per cent. Such a low percentage must refer to a series of cases, in general, much milder than those included in this paper.

In order to facilitate comparison, the different classes of cases will be discussed separately.

1 *Cases Following Abortion and Labor* — Under this heading there were 50 cases with a mortality of 54 per cent., the termination of 2 cases being unknown. Thirty cases followed labor and twenty cases followed abortion. In one case abortion was complicated by tonsillitis, and one case started as a pyelitis with septicæmia for which the treatment was an induced abortion.

The result of the blood culture was in accord with the experience of Western, who, in a careful analysis of 96 cases, found positive cultures in 40 per cent. In 22 cases of the present series the blood cultures were positive (44 per cent.), the majority of the positive cases showing streptococci in the

ninth case an especially virulent infection by the bacillus aerogenes capsulatus. In each of these eight cases the local condition causing the high leucocyte count finally required operation. The nature of the complication and the final results in cases showing high leucocyte counts are shown as follows

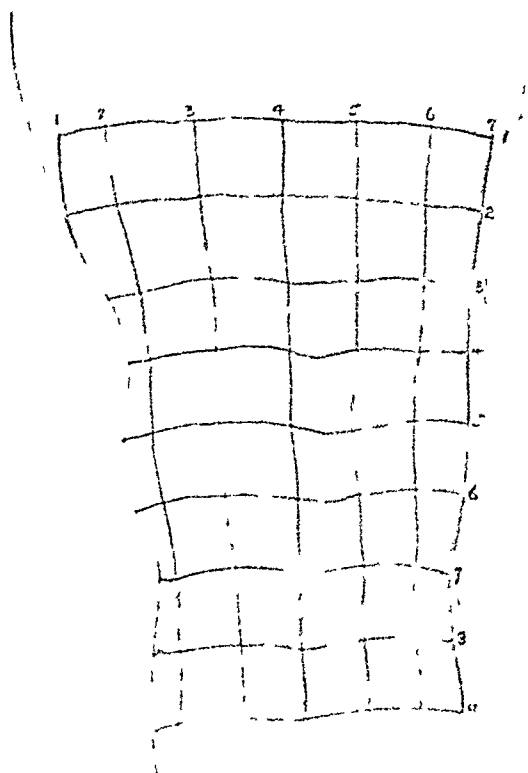
Complication	No of cases	Operated on	Died	Recovered
Pelvic abscess	4	4	2	2
Pneumonia, empyema	1	1	0	1
General peritonitis	1	1	1	0
Abscess (not abdominal)	2	2	1	1

In order to determine the significance of the leucocyte count in the different types of infection, the fatal and cured cases of positive (blood culture) streptococcic cases were compared. The average admission count of 9 fatal cases was 11,100, of 7 cured cases 12,300. Two cured staphylococcic cases showed counts of 12,500 and 10,300 on admission. Consequently the type of infection had little or no influence on the leucocyte count. Cases doing well under treatment usually showed a diminishing leucocyte count with a diminishing percentage of polynuclear cells, and fatal cases frequently showed a decreasing number of leucocytes with an increase of the polynuclears. This rule, however, was not invariable and in some cases it was found exactly reversed.

Of the complications occurring in puerperal septicæmia, peritonitis was the most common, occurring in thirteen cases, femoral phlebitis occurred in seven cases, bronchopneumonia and localized abscess, each in 3 cases, lobar pneumonia, endocarditis, empyema and arthritis, each in 2 cases, and meningitis, strangulated hernia, pyelonephritis, cerebral embolism and acute parotitis, each in one case. In four cases with a positive streptococcus blood culture, localized abscesses showed streptococci three times and staphylococci once.

The symptoms included fever, rapid pulse and prostration in every case. Chills were present in many of the fatal cases but showed no rule, and were often present in cases ending in recovery. A high temperature was a sign of the severity of the infection. About one-half of the cases had a tempera-

FIG 1



Knee showing lines painted upon surface

FIG 2



Case I Anteroposterior view of knee

FIG 3

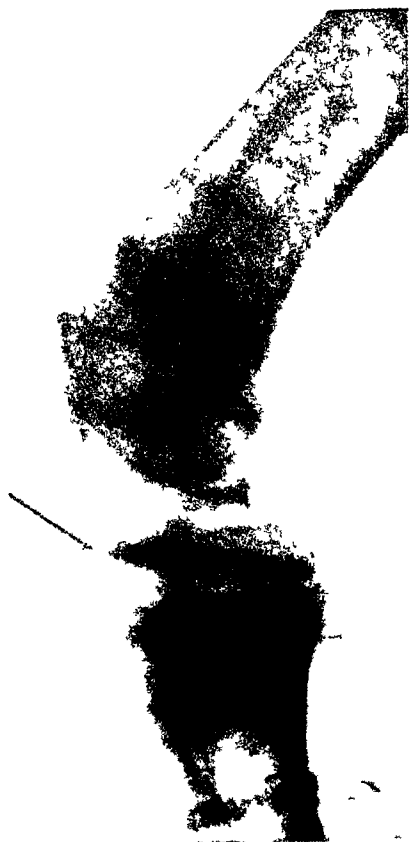


FIG 4



after a preliminary curettage, tending to indicate that complications are more common after early operative interference. This is especially true of pelvic abscess which required drainage six times as often after curettage as after early expectant treatment.

LATE OPERATIONS FOLLOWING CURETTAGE

	Cases	Died	Cured
Laparotomy and drainage	5	2	3
Hysterectomy	1	1	0
Vaginal section	1	0	1
Thoracotomy	1	0	1

LATE OPERATIONS FOLLOWING EXPECTANT TREATMENT

	Cases	Died	Cured
Laparotomy and drainage	1	0	1
Vaginal section	1	0	1
Incision of abscess (not abdominal)	2	1	1

Owing to the uncertainty in the history of many patients, with reference to intra-uterine manipulations, it is difficult to form an estimate of the value of the two forms of early treatment. Ward, in giving the methods employed at the Sloane Hospital, outlines the treatment as follows: "If, despite the douches, the fever remains high, the interior of the uterus is explored. As far as possible all foreign material is removed, always with the idea of the minimum trauma, and a hot saline douche given. No packing or drainage is used unless hemorrhage occurs. It should be said that if a post partum septic case is admitted to the hospital, this exploration takes place at once without waiting for the effect of vaginal and intra-uterine douches." Such procedure appears rational and sufficiently conservative to be in accord with the majority. To-day, there are few, if any, who believe in the more radical operations, such as hysterectomy and ligation of the pelvic veins, but the pendulum has swung so far in the opposite direction that many are urging absolute non-interference, even in cases in which the uterus is known to contain a large septic mass of retained secundines.

The treatment in all these cases was supportive and stimu-

ture over 104° with a mortality of 66 per cent Of the cases in which the temperature was generally below 104° the mortality was lower (about 45 per cent)

The question as to operation, in septicæmia following abortion and labor, is unsettled Murphy, De Lee, Watkins,² and others have strongly condemned operative interference in septic uteri Hirst³ in a questionnaire sent to 273 authorities, including American and European surgeons and gynecologists, found that while the majority (199) believed in cleaning out the uterus, a large number (74) believed in expectant treatment It seems to be generally conceded, however, that after the uterus is once emptied it should be let alone and not re-entered except for hemorrhage

In the present series the operative procedures are conveniently divided, for purposes of study, into the early operations, performed either before or shortly after admission to the hospital, and the late operations, performed after the patient had been under observation long enough to determine whether the infection was stationary or progressive The late operations were usually performed from 15 to 30 days after admission, during which time the patient usually showed some improvement followed by a period in which the symptoms remained stationary or grew gradually worse

FINAL RESULTS OF EARLY OPERATIONS

Operation	No of Cases	Cured	Died	Result unknown
Curettage	21	9	10	2
Laparotomy and drainage	4	1	3	0
Herniotomy and curettage	1	0	1	0
No operation	24	11	13	0

Many of the cases received the curettage before coming to the hospital It is also probable that some of the cases under the head of "no operation" were curetted before admission although they gave no history of an operative procedure before coming to the hospital

Operations later in the course of the illness were necessary in 12 cases In 8 cases the late operation was performed

86 per cent of cases. If then, the streptococcus is present in such a large percentage of the cases, and if we admit the bactericidal properties of antistreptococcic serum, it should be given to every case of puerperal sepsis without waiting for a bacteriological diagnosis.

The vaccine used depends upon the infecting organism and if, as is generally agreed, autogenous vaccines are the best, a certain definite time must elapse before the vaccine can be prepared and administered. During this period the use of stock vaccines has been advised. The reports in favor of vaccine treatment have already been referred to. In a report to the American Gynecological Association, Williams, Cragin, and Newell¹⁰ say that little may be expected of vaccine treatment of puerperal sepsis, the most that can be said according to their report, is that vaccines do no harm. Theobald Smith¹¹ and Schwarz¹² hold somewhat similar opinions.

The results of the present series are distinctly favorable to both vaccine and serum therapy. In general, the mortality was lower in those cases where specific treatment was instituted, and the results seemed especially favorable when serum was given early followed by autogenous vaccine.

TABLE OF ALL CASES RECEIVING SPECIFIC THERAPY

Treatment	Cases	Cured	Died
Serum alone	11	7	4 (36 per cent)
Vaccine alone	3	2	1 (33 per cent)
Serum and vaccine	3	2	1 (33 per cent)

Reports of treatment of cases of proved bacteraemia are even more favorable and indicate clearly the value of serum and vaccine therapy in severe blood infections. Of eleven cases treated by serum or vaccines 6 recovered and 5 died (mortality 46 per cent). Of the six cured cases three received only serum, two received serum and vaccines and one was treated with vaccine alone.

It must not be argued against this series that the high mortality of the untreated cases is due to the inclusion of patients, moribund on admission, who died before vaccines

lating Some of the cases were treated in the open-air with distinct benefit to the appetite and the nervous symptoms Others received drugs directed toward both the symptoms and the general condition The data as to the use of any special drug is too limited to admit of any conclusions

Serum and vaccine treatments have been tried in a sufficiently large number of the cases to be of considerable interest At present the use of vaccines and serum in puerperal sepsis is not on a firm basis It is generally believed that serum does no harm and may do some good, and vaccines, while valuable in chronic processes, can have little influence, except a harmful one, upon an acute process This despite some excellent clinical reports, especially from Western,¹ Wynn² and Rowlette,⁵ in England, as well as Medalia and Watson,⁶ Polak⁷ and others in America

Antistreptococcic serum or vaccines, or in some cases a combination of both, were administered in 17 cases, with 11 recoveries and 6 deaths, a mortality of 35 per cent, as compared with the mortality of the remaining cases (68 per cent), nearly double that of the cases receiving specific treatment

Antistreptococcic serum is bactericidal and consequently must be used early If its administration is delayed until the bacteriological examination is made, much valuable time is lost and good results cannot be expected A large percentage of the cases of puerperal sepsis is due to the streptococcus Based on uterine cultures, this figure is variously given from 28 per cent (Williams⁸) to 78 per cent (Young and Williams⁹) The streptococcus plays a still larger rôle in the bacteriæmic cases The following table gives the percentage of streptococci, staphylococci and other bacteria in cases of bacteriæmia

	Total cases	Bacteriæmia cases	Streptococcus cases	Staphylococcus cases	Other bacteria
Western	96	39	93 per cent	5 per cent	2 per cent
Young and Williams	30	12	58 per cent	17 per cent	25 per cent
Present series	50	22	82 per cent	9 per cent	9 per cent

The paramount cause of puerperal septicæmia, according to Watson and Medalia, is the streptococcus, which occurs in

admission was 6000 and the highest 36,000 average 20,600) No apparent difference could be made out between blood counts of the two types of bacteriæmia The highest count obtained (50,000) was in a child 11 years old (case 52) This high count fell to 16,000 in four days together with improvement in general symptoms Unfortunately after an afebrile period, an abscess of the brain developed which ended fatally on the fifty-sixth day

The differential counts were not significant, the polynuclear cells varying between 72 and 91 per cent in the fatal cases, and 73 and 89 per cent in the cured cases In general a leucocytosis with a moderate or marked increase of the polynuclear elements was the rule and of diagnostic significance. The absence of a leucocytosis, however, does not exclude the possibility of septicæmia

The treatment consisted of incisions of local accumulations of pus wherever present, together with the usual supportive measures There were fourteen cases with a positive blood culture, with three recoveries and eleven deaths (89 per cent), four of which received vaccines with a mortality of only 25 per cent The mortality of the untreated cases in this series was 100 per cent Two cases received vaccines in combination with antistreptococcic serum, one of which recovered One case recovered under treatment with autogenous streptococcic vaccines and one recovered under treatment with stock staphylococcic vaccine

TABLE SHOWING RESULTS OF VACCINE TREATMENT IN BACTERIÆMIA

	Vaccines		No vaccines	
	Cases	Died	Cases	Died
Streptococcus	3	1	6	6
Staphylococcus	1	0	4	4
	—	—	—	—
Totals	4	1*	10	10†

* 25 per cent † 100 per cent

It should be stated that the one case (Case 52) dying under vaccine treatment showed marked improvement following the use of vaccines and serum, and died on the fifty-sixth day after an operation for brain abscess

could be administered. On the contrary most of the untreated fatal cases of bacteraemia occurred before the general use of vaccines and were under observation for from five to twenty days (5, 6, 11, 19, and 20 days respectively), a sufficient time to have instituted both serum and vaccine treatment had such been deemed advisable.

COMPARATIVE TABLE SHOWING RESULTS OF TREATMENT OF BACTERIÆMIA

	Total cases	Specific treatment		No specific treatment	
		Cases	Died	Cases	Died
1 Streptococcus	36	23	11 (61 per cent)	13	12 (92 per cent)
Western		6	1 (17 per cent)		
Wynn		28	6 (21 per cent)		
Polak	17	11	5 (46 per cent)	6	5 (83 per cent)
Present series					
2 Staphylococcus					
Western	2	1	0	1	1
Polak	2	12	1 (8 per cent)	1	0
Present series		1	0		

2 Cases Following Infected Wounds and Abscesses—

There were twenty cases in this group with a general mortality of 75 per cent. Most of the cases occurred during early adult life as follows: 10 to 20 two cases, 20 to 30 ten cases; 30 to 40 five cases, over 40 two cases. Eleven cases followed lesions of the extremities, five followed lesions about the head, two followed tonsillectomy, one case followed erysipelas and one followed appendix abscess. The blood cultures were positive in 14 cases (streptococcus 9 times and staphylococcus aureus 5 times), in 3 cases there was no growth, and in 3 cases cultures were not made. A local cellulitis was the most common complication, occurring in 15 cases. Suppurative arthritis occurred in 5 cases, bronchopneumonia in 4 cases, adenitis in 2 cases and furunculosis, pericarditis, endocarditis, lung abscess, brain abscess, perineal abscess and erysipelas each in 1 case.

The leucocyte count showed little of prognostic value. A moderate leucocytosis was the rule and very high or very low counts were the exception. On admission the counts of the cured cases were between 11,000 and 22,400 (average 15,600). Of the rapidly fatal cases the lowest count on

Bionchopneumonia was the most frequent complication, occurring in three cases, empyema and pyæmia each occurred in one case. Although five cases began as an apparent arthritis, practically every case showed osteitis in some form during the course of the disease.

The treatment of these cases consisted in operative procedures directed against the foci of infection and mechanical treatment for the inflamed joints, together with the usual supportive measures. Vaccines were used in four cases of staphylococcic bacteriæmia with two recoveries and two deaths, a mortality of 50 per cent which compares favorably with the mortality of the entire series which was 78 per cent. In fact, as was the case in the preceding group, the only cases which recovered were those receiving vaccines.

4 *Cases Associated With Endocarditis and Pericarditis* — For completeness these cases are included, for, while septicæmia is always present in malignant endocarditis, the condition is essentially different from the cases previously discussed and merits separate consideration. There were 16 cases, all showing a positive blood culture and all ending fatally. The results of the blood cultures were as follows:

Streptococci	12 cases
Streptococci and pneumococci	1 case
Staphylococci	2 cases
Meningococci	1 case

The disease was usually of long duration, many cases dying several months after the onset of symptoms. In a disease of such high mortality little can be learned from treatment. Five cases received vaccines, one received antistreptococcic serum and one received antimeningitis serum. The results were apparently nil. Wynn,⁴ who has had remarkably good results in other types of bacteriæmia, has reported fifteen cases associated with endocarditis treated with vaccines with no recoveries.

5 *Miscellaneous Cases* — Under this heading are included those cases which did not fall under the other headings. Of course cases where the blood culture gave evidence of a bacteri-

Does the vaccine treatment favor the localization of purulent foci? In each of the cases treated by vaccines in this series one or more operations were necessary late in the course of the disease for the relief of localized collections of pus. In two cases the knee was involved, in the third case one of the phalanges showed osteitis and required operation, and in the fourth case there was a brain abscess which finally caused death.

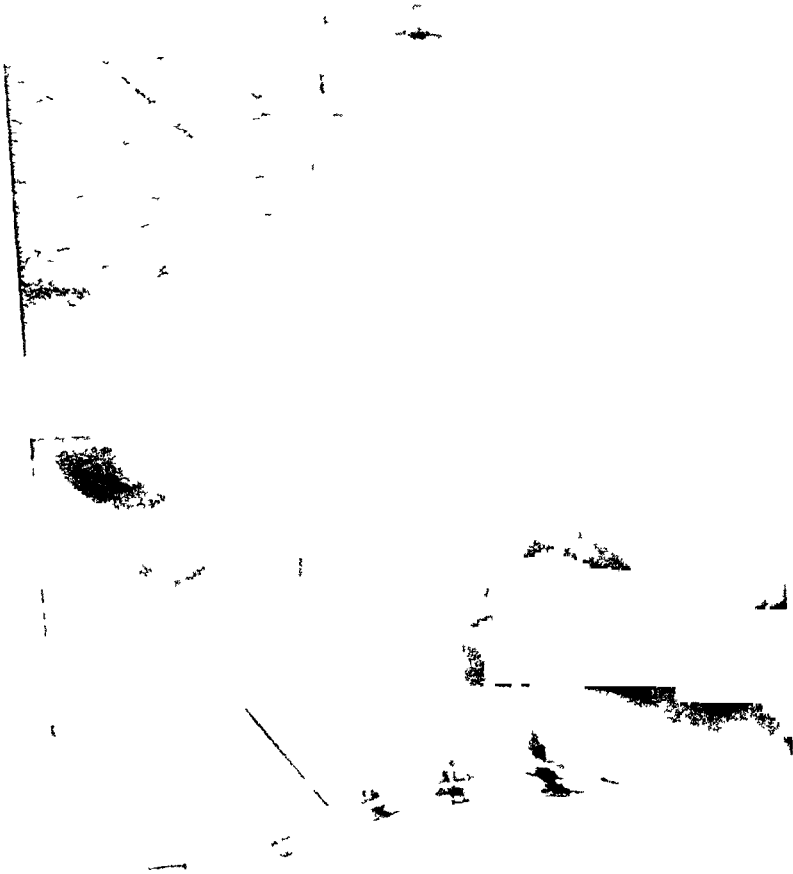
The results of vaccine treatment in this series may be said to have been decidedly favorable and to warrant further trial.

3 *Cases Following Osteomyelitis and Arthritis*—Nine cases occurred in this group with seven fatalities. Unlike the two preceding groups these cases occurred most commonly during childhood and showed other variations to the types discussed above. The youngest patient was five years old and seven of the nine cases occurred before the twenty-first birthday. The other two occurred in patients 35 and 36 years respectively. Five cases began as a monarticular arthritis and four began as a frank osteomyelitis. The arthritis cases were frequently treated for days or weeks before admission to the hospital. Indeed, the diagnosis may be very difficult, as is shown by the records of one patient (Case 28) who was in the hospital 10 days before the diagnosis could be made.

The blood cultures, again in contra-distinction to the other groups, showed the staphylococcus to be the most common etiological agent. Of six cases in which the blood culture was positive, the staphylococcus was present four times, and the streptococcus twice. In 40 cases of staphylococcic bacteriæmia collected by Soper,¹³ including the 4 cases in this series, osteomyelitis was present in 16 cases and suppurative arthritis in 10 cases.

The temperature in the two types of bacteriæmia showed some differences which were absent in the previous groups. In the streptococcus cases which were both rapidly fatal, the temperature was high, from 102° to 106°, while in the staphylococcus cases it was usually low, rarely going above 102°.

FIG 5



Case III Anteroposterior and lateral views of foot

æmia which was part of the disease, as typhoid bacteriæmia in typhoid fever, were not included in this report. In a few the bacteriæmia was a complication to some other equally serious disease and little could have been expected from any plan of treatment. There were 16 cases with 11 deaths, and 4 recoveries and one case in which the final result is unknown. Infected uterine fibromata were the apparent cause of two cases, again emphasizing the rôle of the uterus in general blood infections. In two cases the septicæmia was apparently a complication of thrombophlebitis, making a total of nine cases in which the two conditions were associated. In three cases meningitis was complicated by bacteriæmia, one of which recovered. This case has been reported in detail by Bovaird¹¹ (Case 45). The following table shows the cases in which there were positive blood cultures.

Case No	Complication	Blood culture	Specific treatment	Result
16	Infected fibroids	Streptococcus	None	Died fourth day
45	None	Meningococcus	Serum	Cured
48	Carcinoma nephritis	Streptococcus	None	Died sixth day
54	None	Bacillus proteus vulgaris	None	Cured
57	Phlebitis	Streptococcus	None	Died second day
60	Phlebitis pneumonia	Staphylococcus	None	Died nineteenth day
105	Cholelithiasis	Bacillus coli communis	None	Died nineteenth day
107	Pyelonephritis	Bacillus coli communis	None	Died fifth day
108	Multiple arthritis	Gonococcus	Vaccine	Died sixtieth day
109	Meningitis	Pneumococcus	None	Died third day
110	Meningitis	Streptococcus	None	Died fourth day
111	Typhoid	Bacillus coli communis	None	Cured

The two cases of infected fibroids died shortly after hysterectomy, one case showing a positive blood culture. In general, the results of treatment in these miscellaneous cases have been bad, possibly due in part to the severity of the complicating disease.

A table of all the cases having a positive blood culture has been prepared in order to show more clearly the results of treatment. For obvious reasons Group 4 has been excluded. The cases in Group 5 have already been tabulated and, as will be easily seen, are unsuitable for comparison with the first three groups.

There are included in the table 42 cases of proved bacteriæmia, in 41 of which the final outcome is known. Case

CASES FOLLOWING INFECTED WOUNDS AND ABSCESES

Case No	Apparent cause or associated lesion	Temperature	Blood culture	Local culture	Complications	Specific treatment	Result	Day	Remarks
20	Cellulitis of face	H	Staph	Staph	None	None	D	2	
25	Infected wound	M	Staph	Staph	Arthritis	Vaccine on ninth day	D	11	
29	Infected wound	H	Strep	Mixed	Abscess	Serum on eighth day	D	8	
31	Infected wound	H	Strep	Mixed	Cellulitis	None	D	10	
33	Carbuncle	H	Staph	Staph	Osteomyelitis	Stock vaccine	C		
34	Furunculosis	L	Staph	Staph	Nephritis	None	D	5	
44	Infected wound	H	Strep	Staph	Cellulitis, pneumonia	Vaccine	C		
46	Infected wound	H	Strep	Strep	Cellulitis, pneumonia	None	D	13	
49	Tonsillectomy	H	Strep	Mixed	Abscess of lung pneumonia	None	D	5	
52	Infected wound	H	Strep		Brain abscess	Serum for eight days vaccine on eighth day	D	56	Craniotomy on fifty-fifth day
53	Erysipelas	H	Staph aureus		Erysipelas	None	D	2	
55	Infected wound	H	Strep		Perineal abscess	None	D	8	
56	Infected bunion	M	Strep		Endocarditis arthritis	None	D	4	
80	Tonsillitis, abscess neck	H	Strep	Strep	Arthritis, cerv abscess of knee	Serum on first day vaccine on fifth day	C		

CASES FOLLOWING OSTEOMYELITIS AND ARTHRITIS

Case No	Apparent cause or associated lesion	Temperature	Blood culture	Local culture	Complications	Specific treatment	Result	Day	Remarks
15	Osteomyelitis	H	Strep	Mixed	None	None	D	2	
18	Osteomyelitis	L	Staph	Staph	Pneumonia, empyema	Vaccine 2 doses	D	14	
22	Osteomyelitis	L	Staph	Staph	None	Vaccines on eighth day	C		
24	Osteomyelitis	M	Staph	Staph	Pyæmia	Vaccines	D	28	
28	Arthritis	L	Staph	Staph	Osteomyelitis	Vaccines	C		
32	Arthritis	H	Strep		None	None	D	3	

Tables showing all cases in which the blood cultures were positive
 Temp H=temp over 104°, M=temp 102°-104°, L=temp below 102° Result
 D=died C=recovered ?=termination unknown Day Number signifies days after
 admission to hospital Specific Treatment refers to vaccine or serum therapy and day of
 beginning treatment

Of the 9 cured cases *every case but one* was treated with either vaccines or serums. On the other hand, there were two cases treated with vaccines which ended fatally (Cases 23 and 52), one of these cases received only one dose of vaccine and

68 left the hospital on the fourteenth day, and may be disregarded in computing the averages of the results of treatment

CASES FOLLOWING ABORTION AND LABOR

Case No	Apparent cause or associated lesion	Temperature	Blood culture	Local culture	Complications	Specific treatment	Result	Day	Remarks
1	Abortion	H	Strep	Staph	Meningitis	None	D	5	Pneumococcus meningitis
11	Abortion		B aer caps		None	None	D	1	Culture made post mortem
23	Abortion	M	Strep		Pneumonia	Vaccine on tenth day	D	11	
26	Abortion	L	B aer caps	B aer caps	Nephritis	None	D	1	
30	Abortion	M	Strep		Strang hernia	Serum 100 cc on fifth day	D	6	
36	Abortion	H	Strep		None	Serum on first day	D	6	
39	Abortion	H	Strep		Pneumonia	Serum on fourth day	D	5	
62	Ante partum	M	Staph	B coli com	Pyelitis	Vaccine bacillus coli	C		Abortion induced on 22nd day
65	Post partum	M	Strep		Phlebitis	Vaccines	C		
66	Post partum	M	Strep		Phlebitis	None	D	11	
67	Post partum	H	Strep	Strep	Phlebitis	None	D	20	
68	Abortion	H	Strep		None	Vaccine dose 1	?		Left hospital 14th day
70	Post partum	H	Strep		Phlebitis	None	D	19	
81	Post partum	H	Strep	Strep	Endocarditis pyæmia	None	D	6	
82	Post partum	M	Strep	Sterile	Pelvic abscess	Serum on first day	C		
83	Post partum	L	Staph		Phlebitis, arthritis	Vaccine 2 doses	C		
85	Post partum	M	Strep		Pyosalpinx	None	C		
86	Post partum	M	Strep		Phlebitis, axillary abscess, arthritis	Serum on first day, vaccine on third day	C		
88	Abortion	H	Strep	Staph	None	Serum on first day, vaccine on second day	D	11	
90	Post partum	H	Strep		None	Serum on fourth day	C		
92	Post partum	M	Strep	Strep	Pneumonia, empyema	Serum on first day	C		
95	Post partum	L	Strep		Phlebitis	Serum on first day, vaccine on second day	C		

Of these 41 cases there were 14 recoveries and 27 deaths, a general mortality of 66 per cent. There were 28 cases of streptococcic bacteriæmia with 9 recoveries and 19 deaths

left the hospital on the tenth day and received the vaccines while under the care of his own physician. It is included here because the diagnosis is certain, his condition was extremely grave, and a decidedly bad prognosis was given when he left the hospital. In all the staphylococcus cases the staphylococcus aureus was the organism isolated.

Two positive cases of bacillus aerogenes capsulatus bacteraemia occurred, both coming to a fatal issue within twenty-four hours.

The following table gives at a glance the results of the different methods of treatment.

		Cured	Died
Streptococcus, (28 cases)	Vaccine treatment	5	2
	Serum treatment	3	4
	No specific treatment	1	13
Staphylococcus, (11 cases)	Vaccine treatment	4	3
	No specific treatment	1	3
Bacillus aerogenes capsulatus (2 cases)		0	2
		—	—
Total		14	27

Reference should be made here to some of the other methods of treating septicæmia which are advised and which have been used to a considerable extent. Cheyne¹⁶ advises quinine in full doses, together with polyvalent antistreptococcus serum. Watkins² and Young and Williams⁹ advise out-door treatment. Lobenstine¹⁷ has reported the use of intravenous infusions of magnesium sulphate in one case with success. A few years ago formalin was used in some infections of this type, but it was soon discarded as useless.

Credé¹⁸ gives from 2 to 10 c c of a two per cent solution of collargol intravenously. This drug has been quite extensively used, but there is little reference to it in the recent literature except by Wolf,¹⁹ who reports one case cured by means of collargol enemata. Its value is problematic. More recently, especially in Italy and France, considerable praise has been given to mercury in the treatment of general sepsis (Girou,²⁰ Schmidlechner,²¹ Stowe²²). In the few cases I have found in which a proved bacteraemia was present, the results have been bad. Schmidlechner reports six cases of

the other was the case already mentioned which died after operation from brain abscess. The first of these failures cannot speak against vaccine therapy and the effect of the vaccine on the general septicæmia in case 52 was all that could be wished.

Serum alone was given in 7 cases of streptococcic bacteriæmia with three recoveries and four deaths. The writer believes that in some cases the serum was given so late and in such small doses that little could have been expected. Cases rarely reacted favorably to less than 40 c c daily and some cases received 100 c c or more at a single dose. It may be noted here that antistreptococcic serum loses its complement after it has been kept for some time and when the fresh serum is not obtainable a certain amount of fresh horse serum should be added to each dose¹⁵. It is said that fresh horse serum complement is better adapted to the antistreptococcic serum than is human complement. The commercial polyvalent serum was used, except in a few of the recent cases in which the serum supplied by the New York City Board of Health was used. Apparently the results in the more recent cases were a little better than the earlier results, either because the serum was fresher, or because of the difference in the character of the serum. Vaccines, either alone or in combination with antistreptococcic serum, were given 7 cases of streptococcus bacteriæmia with 5 recoveries and 2 deaths. Among similar cases, receiving no specific treatment, there were 13 deaths and only one recovery.

Of the staphylococcus cases there were 11 cases and 6 deaths, a general mortality of 55 per cent. Of the cases treated with vaccines there were 4 recoveries and 3 deaths. Among the untreated cases there was only one recovery. This case (No. 62) was treated with colon bacillus vaccine for pyelitis complicating pregnancy, during the course of which she developed a staphylococcus bacteriæmia. Following an induced abortion both conditions improved. In discussing the use of vaccines in the treatment of bacteriæmia such a case should properly be included among the cases *not* receiving vaccines. The case receiving the stock staphylococcus vaccines (Case 33)

NOTE—I desire to express my thanks to the attending staff of the Presbyterian Hospital for permission to publish these reports and especially to Dr Ellsworth Eliot, Jr, for his advice and criticism in the preparation of this paper

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streptococcic bacteraemia treated with mercury in which there was only one recovery

In all of these methods the object has been the sterilization of the blood by the use of drugs, the so-called chemotherapy, in contradistinction to the conquest of the infection by methods designed to increase the resistance of the patient, immunotherapy While the results of the drug treatment of bacteraemia have been disappointing heretofore, the remarkable success of Ehrlich's salvarsan in the treatment of syphilis, gives promise of a similar therapy for other general infections

CONCLUSIONS

1 Septicæmia with true bacteraemia is a disease of great severity and of exceedingly high mortality, but, except in the type associated with malignant endocarditis, and in terminal infections, many cases are amenable to treatment

2 Vaccines are of benefit in many of the cases not overwhelmed at the onset by the severity of the infection, and, clinically, seem to benefit the majority of the cases

3 Antistreptococcic serum is of great value, especially during the early stage when its bactericidal powers are most pronounced, and if given in sufficient dosage during the period of invasion will often change a systemic bacteraemia into a localized infection

4 The combination of antistreptococcic serum, used in the early stage of septicæmia, together with autogenous vaccines, used as soon as they can be prepared from blood cultures, seems to be particularly beneficial If the blood cultures are sterile, vaccines may be prepared from the local lesion, although this method is unsatisfactory and may lead to errors Stock vaccines are still less desirable, and are of uncertain value

5 Neither sera nor vaccines, although they usually do little harm, are free from danger, and the dosage and intervals need to be carefully worked out

6 Open-air treatment in cases in which cultures are sterile and as an adjunct to vaccine and serum therapy seems to be the best method of increasing the resistance of the patient

The finger is then inserted under this capsule and the entire gland carefully explored to determine the size of the lobes, the relations of the trachea, and the presence of any substernal, retrotracheal or other isolated portion of gland

It is now possible to decide upon what should be the further operative procedure. If the exploration reveals a single encapsulated adenoma or cyst in one lobe with an apparently normal lobe on the opposite side, extirpation of the involved lobe or enucleation of the tumor with division of the isthmus is usually sufficient. If, however, as is so much more frequently found, both lobes are involved in the same process, that is, a diffuse colloid condition, or multiple adenomata of various sizes, we believe the removal of the diseased portion of each lobe is the operation of choice. As a preliminary step, it is often possible to dislocate both lobes from their positions by careful finger-manipulation, after freeing any lateral or accessory veins. In this manner the entire gland in many cases can be traced to a situation as shown in Fig 1

It is immediately obvious in a large percentage of cases that removal of the larger lobe will be inefficient in relieving both pressure and deformity, and offers considerable possibility of recurrence of the trouble not only by later enlargement of the remaining lobe, but also because of the retraction beyond even the natural contour of the normal neck which may take place on the side from which the lobe has been removed. A double resection, therefore, in this group of cases seems to be the ideal procedure and is being more and more frequently employed by us. During 1913, of 1569 operations on patients with various types of goiters, 783 were of the non-toxic or non-exophthalmic type, 583 of which were for so called multiple or diffuse colloid adenomas. In this latter group of patients, 295 or 55 per cent, were operated on by the double resection method, 116 (21.7 per cent) had an extirpation of one lobe and isthmus, 122 (23 per cent) had extirpation of one lobe, isthmus and part of the other lobe.

Both lobes are dislocated if possible. In doing this completely one often finds that one or both lobes have a tendency to become flattened out and extend behind the trachea so that this structure is frequently entirely surrounded by the thyroid tissue. By careful traction the entire lobe of each side can be exposed, and by inspection it can be determined what portion of each should be removed in order to obtain a good end-result.

The first step in the actual removal consists of a division of the isthmus. This in some cases entails considerable oozing, especially when the structure is of any thickness, but in the majority of cases, if the operation is done with care and an effort made to find the narrowest part, little difficulty will be encountered. In some cases the isthmus can be lifted from the trachea, two forceps clamped entirely across, and complete division made between these. The segment of isthmus of one side is then freed from any further attachment to the trachea and by steady traction and careful dissection the lobe on that side is freed from the trachea anteriorly and laterally sufficiently to relieve all pressure and to permit of satisfactory suturing after the resection. The other half of isthmus and the opposite lobe are then freed in the same way, disclosing the arrangement of the parts shown in Fig 2

THE ADVANTAGES OF THE DOUBLE RESECTION IN CERTAIN TYPES OF GOITER.

BY DONALD C BALFOUR, M.D.,
OF ROCHESTER, MINNESOTA

(From the Mayo Clinic)

THE surgery of the non-toxic and non-malignant enlarged thyroid at the present time is attended by practically no mortality. That this fact is known to the laity is evidenced by the increasing frequency of operations on the thyroid by surgeons who are attaining good results, both immediate and ultimate. Realizing, then, that the development of the operative treatment of the thyroid has made safe, in so far as life is concerned, the removal of the so-called simple goiter, further advancement must be made in refinement of technic, in lessening the possibilities of complications, in improving the end-results, and in obviating, as much as possible, recurrence of the condition.

Patients with thyroid enlargement without any evidence of toxæmia attributable to the goiter usually desire its removal only for mechanical and cosmetic reasons—that is, pressure and deformity. It is in this group that not only is safety imperative, but also an operation which will offer the patient the greatest probability of permanent relief. With this in mind, I wish to describe a type of operation which, while not original in this clinic—it being but a modification of the Mikulicz resection—is being used more and more frequently and with most satisfactory results. The operation is performed as follows:

The usual low-collar incision is made, the external jugular vein marking the limits of the incision laterally. The subcutaneous tissue and platysma are then reflected, the upper flap as high as the thyroid cartilage, the lower flap to the sternal notch. The vertical muscles, sternohyoid and sternothyroid of one side are then separated from those of the opposite side by dividing in the midline, from the thyroid cartilage to just above the sternal notch. The thin peritoneum-like fibrous covering of the gland will then be exposed and this should be freed over the front of both lobes.

any possibility of removal, injury or interference with the circulation of the parathyroids. This operation is of particular value in treating large goiters which by long continued pressure on the trachea have caused a softening of the rings. In these cases a temporary tracheal collapse sometimes occurs when the pressure on one side is relieved and the surgeon is in an awkward predicament under such circumstances, if the trachea is not quickly available. By this method the exposure of the trachea as a first step gives immediate and continuous control of the situation.

The benefits to the patient from this type of operation are well defined. All sense of pressure is relieved, and the neck is made quite symmetrical, which cannot be said of some of the cases in which an entire lobe has been removed and the opposite lobe left untouched. After such an operation one can assure the patient that there will be much less liability of recurrence of the goiter than with any other type of operation.

The cases to which this operation is applicable are in general the diffuse colloid adenomas. It is not necessary, of course, in the single cystic thyroid, where the trouble is due to an isolated tumor in the gland. It has a very limited field in the exophthalmic group where symmetry is a secondary consideration and the patient is operated for relief of symptoms only.

Either lobe is now resected. The following has been found a convenient and safe method. A series of Ochsner forceps are applied somewhat as follows. One at the superior pole, as a rule about an inch from the upper extremity, one at the inferior pole, three or four laterally, placed on the larger vessels in the capsule and two or three on the tracheal side. These forceps appropriately placed serve the joint purpose of marking the limitations of the resection and of enabling one to control hemorrhage by traction on them along with support of the lobe from behind with the finger. The lobe is then encircled with an incision through the capsule just above the forceps. The resection is then made by "wedging" out the interior of the gland. In practically all multiple adenomas the colloid masses will separate easily from the healthy gland by finger enucleation. In the diffuse colloid glands without tumors the proper portion to resect is readily determined. Having completed this there will be remaining the superior pole, the entire posterior capsule with a layer of gland-tissue and oftentimes the inferior pole, so that the portion of the gland most closely approaching the normal has been retained. This cup-shaped structure is now rebuilt into a compact strip of gland-tissue by suture. We have found the following method of suturing very satisfactory. Starting at either pole, a continuous mattress suture of plain catgut from outer to inner capsule is inserted behind the line of forceps originally placed on the capsule and continued to the other extremity of the lobe. This controls practically all the bleeding and obliterates the cavity in the centre of the lobe. The same suture, returning in an opposite direction, by a locking or button-hole stitch catches the edge of the capsule and rolls the two edges together into some semblance to a normal lobe. This reconstructed lobe is then allowed to drop back into the space formerly occupied by the enlarged gland. The opposite side is treated in the same way, resecting as much as seems necessary.

The proper amount of thyroid to be left cannot be stated in actual figures. In no case in which this method of resection has been used has there been any evidence of too much thyroid having been removed.

The difficulties of this type of operation become less with increasing experience, and I believe are more than compensated for by the distinct advantages obtained. In the first place, the operation is eminently safe in all respects. Control of hemorrhage is more certain, if possible, by suture than by ligation. Danger of injury to the recurrent laryngeal nerve is greatly minimized and can hardly occur if the operation is properly performed. Free dissection of the gland from the trachea is permissible and gives an opportunity for much easier and efficient control of bleeding by suturing from internal to external capsule. The fact that the superior and inferior poles and the entire posterior part of capsule are retained precludes

THE FREQUENCY OF CARCINOMA OF THE APPENDIX.

A REPORT OF 40 CASES (44 PER CENT) IN 8039 SPECIMENS

BY WM CARPENTER MacCARTY, M D,

AND

BERNARD FRANCIS McGRATH, M.D.,

OF ROCHESTER, MINNESOTA

(From the Mayo Clinic)

THE frequency with which carcinoma of the appendix occurred in the surgical material of the Mayo Clinic during a routine examination of appendices which had been removed primarily or secondarily has stimulated the writers to investigate further the regularity and frequency of its occurrence In a previous report¹ 22 specimens which presented histological pictures of carcinoma occur in 5000 specimens Only five of these were large enough to be suspected at operation The remaining 17 were discovered only upon making routine gross serial sections The neoplasm was not visible upon the external surface and occurred always in appendices in which the lumen had been partially or completely obliterated

In the published series the condition occurred in the following frequency

- 5 ($\frac{1}{2}$ per cent) in the first 1000
- 7 (7/10 per cent) in the second 1000
- 3 (3/10 per cent) in the third 1000
- 2 (2/10 per cent) in the fourth 1000
- 5 ($\frac{1}{2}$ per cent) in the fifth 1000

The youngest (five years) occurred in a female who was operated upon for appendicitis The average age was thirty

¹ MacCarty and McGrath Clinical and Pathological Significance of Obliteration, Carcinoma and Diverticulum of the Appendix Surgery, Gynecology and Obstetrics, March, 1911

it was given up. Subsequent to localization by the method above described, an oblique incision across the shadow of the needle in the appropriate square resulted in its removal. The entire time of operation, including the joint repair, was fifty minutes.

CASE II—*Needle in the back* (Fig 4) Two weeks before admission a child thrust a needle into the patient's back and the needle broke. The point of entrance was situated on the left side about two inches outside the outer border of the erector spinæ muscle. The radiograph taken after the skin had been marked out into squares showed the needle lying approximately in the long axis of the body near the spinous process of the third lumbar vertebra and traversing the longitudinal extent of one square. An incision over the appropriate square disclosed the needle lying beneath the aponeurosis in the substance of the erector spinæ muscle. It was recovered at operation in five minutes.

CASE III—*Needle in the foot* (Fig 5) This case disclosed the fact that it is necessary for the operator to know the position of the tube at the time of skiagraphic examination. Five days before admission the child stepped upon a needle, driving it into the sole of the foot and breaking it off. The point of entrance was half an inch external to the inner border of the foot and half way from the posterior border of the heel to the first metatarsophalangeal articulation. Skiagraphic examination, after the skin had been prepared according to the above method, showed the needle obliquely placed, nearer the outer border of the foot than the inner and lying across two squares, the base of the needle about half an inch from the surface. As the X-ray tube could not be placed directly above the foot when taking the skiagraph because of the presence of the leg the rays met the photographic plate at an oblique angle. As a result the shadow of the needle in its relation to the surface lines was shifted because the surface lines rested directly upon the plate while the needle was deeper in the tissues and consequently farther away, hence, the rays had to travel a distance of from half an inch to an inch in an oblique direction before striking the plate. During the first part of the operation this was not taken into account, but when the needle was not found immediately, the source of error was recognized and a slight lengthening of the incision in the proper direction resulted in the finding of the needle. Time of operation, twenty minutes.

CARCINOMA OF THE APPENDIX

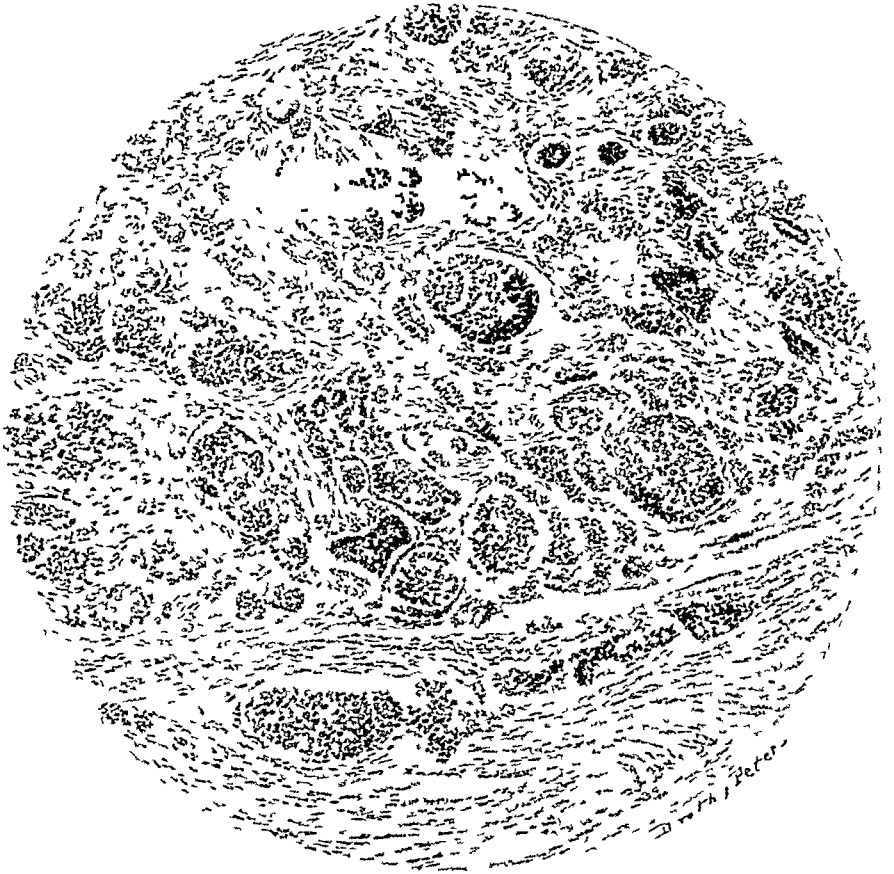
43694	22	F	6 mos	Epigastrium					Carcinoma of appendix	
43933	44	M	15 yrs	Epigastrium					Chronic catarrhal cholecystitis Chronic pericholecystitis Chronic catarrhal appendicitis with stenosis of canal in distal one-third Carcinoma at tip	
44138	10	M	9 mo	Lower lt quadrant					+	
44170	37	F	5 yrs	Lower abdomen						
44255	36	F	5 yrs	Epigastrium, rt iliac fossa						
44537	27	F	11 yrs	Epigastrium					+	
45406	31	F	11 yrs	Epigastrium					+	
45446	39	F	8 yrs	Rt iliac fossa						
47148	22	M	2 yrs	Rt iliac fossa						
48430	17	F	8½ mos	Rt iliac fossa					+	
48974	27	M	4 yrs	Epigastrium						
49974	30	M	7 yrs	Epigastrium						
49976	28	F	3 yrs	Rt iliac fossa					+	
50920	10	F	4 yrs	Rt iliac fossa						
51904	34	M	4 das	Under rt costal arch					+	
52076	32	F	2 mos	Rt iliac fossa						
53526	26	F	19 yrs	Abdomen					+	
54098	44	F	7 mos	Rt of umbilicus					+	

TABLE OF CASES

Hosp No	Age	Sex	Duration of symptoms	Location of pain	Fever	Vomiting	Jaundice	Condition found
28043	26	F	4 yrs	Rt iliac region	+			Chronic appendicitis
28359	50	F	15 yrs	Umbilical region, rt iliac region				Chronic appendicitis Tumor on end of appendix carcinoma
26527	25	F	4 yrs 3 yrs	Epigastrium Rt iliac region				Chronic cystic appendicitis
18030	33	M	2 yrs	Abdomen (gen), rt iliac region	+	+		Cirrhosis of liver Carcinoma at base of appendix
17259	20	F	Several yrs	Rt iliac region				Subacute appendicitis Carcinoma of tip of appendix
31005	23	F	8 yrs	Rt iliac region to back	+	+		Chronic appendicitis
25862	30	M	1 yr	Abdomen (gen), rt iliac region	+	+		Chronic appendicitis
31023	37	F	4 yrs	Umbilical region, rt iliac region	+	+		Chronic appendicitis Gall-bladder thickened
31326	26	F	8 yrs	Rt hypochondrium, rt iliac region	+	+		Chronic appendicitis
31679	5	F	Since birth	Rt iliac region	+	+		Chronic appendicitis Enlarged glands in the mesentery
32898	22	F	8 mos	Rt iliac region	+	+		Chronic appendicitis
29613	27	F	7 wks	Rt iliac region, rt hypochondrium			+	Chronic appendicitis (adherent)
24497	42	M	3 mos	Epigastrium				Right inguinal hernia Chronic appendicitis
34532	80	M	10 yrs					Four stones in urinary bladder
A33079		F						Subacute appendicitis Cholelithiasis
32682	34	F	4 mos	Rt iliac region		+		Endometritis and uterine fibroids Appendicitis, Carcinoma of the tip of the appendix
31580	16	F	2 yrs 10 das	Rt iliac region	+			Acute appendicitis
21362	29	M	11 yrs	Rt iliac region	+	+		Acute appendicitis Small abscess in omentum
23043	26	F	2 yrs	Rt hypochondrium		+	+	

*Labels blurred or lost

FIG 1



No 31005 Involvement of the submucosa and the musculature by carcinoma

years Seventy-three per cent were females Ninety per cent occurred near the tip of the appendix

It was found that the average duration of symptoms was 3.3 years One in every 225 of all appendices in the series and one in every 53 partially or completely obliterated appendices were carcinomatous Thirty-one per cent was found in association with other abdominal and pelvic conditions

Since these findings were made, 3039 specimens which were removed between November 15, 1911, and July 1, 1913, have been examined immediately upon removal In this later series 18 (6/10 per cent) were carcinomatous In all specimens the lesion occurred at or near the tip and in a portion, the lumen of which had been obliterated In none of these was there any gross evidence of the condition at operation The findings were only made upon careful examination in the surgical laboratory The lesion itself consisted of islands or masses of epithelial cells, which were scattered throughout the submucosa, muscularis and subserosa (Figs 1 and 2)

The nuclei presented the irregularities which are characteristic of carcinomatous cells (Fig 2)

The present interest which stimulated this report rests upon a desire on the part of the investigators to learn something about the clinical significance of the condition

In none of the cases herewith presented was there any fact which pointed to clinical importance However, the mere fact that such a condition is comparatively frequent and, indeed, rather a constant finding is significant enough to warrant closer study of the appendix in view of the possibility of more extensive changes

Surgeons and pathologists are therefore urged to closely examine all such cases and note the presence of metastases if such occur

A CONSIDERATION OF CERTAIN COEXISTING LESIONS OF THE GALL-BLADDER AND KIDNEY.*

BY ELLSWORTH ELIOT, JR., M D,

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THE clinical features of a given lesion vary least in uncomplicated lesions of single organs. While, even in cases of this kind, the symptoms may prove so exceptional as to make diagnosis difficult, this difficulty is still further increased and becomes more common when more than one organ is involved. If, in this way, the lesion is multiple, a distinction must be made between those cases in which other organs gradually become involved by an extension of the primary lesion, as for example, the metastases of malignant growths, those cases in which multiple lesions, occurring simultaneously or in sequence but independently, are probably due to a common cause or diathesis, as for example, certain multiple benign neoplasms such as lipoma, those cases in which the lesions as well as their associated clinical features are considerably modified either by the consecutive development or by the coexistence of two or more individual agents of infection, and finally, those cases in which the actual diagnosis is greatly obscured by the coexistence of two or more entirely separate and independent lesions in organs lying in juxtaposition, in any one of which, when occurring singly, no special difficulty in diagnosis would be encountered.

In cases of multiple lesions in which secondary lesions develop, or in those cases in which all lesions irrespective of the time of their appearance, may be ascribed to a common cause, clinical observation and research, extended over many centuries, has standardized and facilitated the methods of diag-

* Read before the New York Surgical Society, January 14, 1914

No 31005 Showing the irregular character of the nuclei in early carcinoma of the appendix

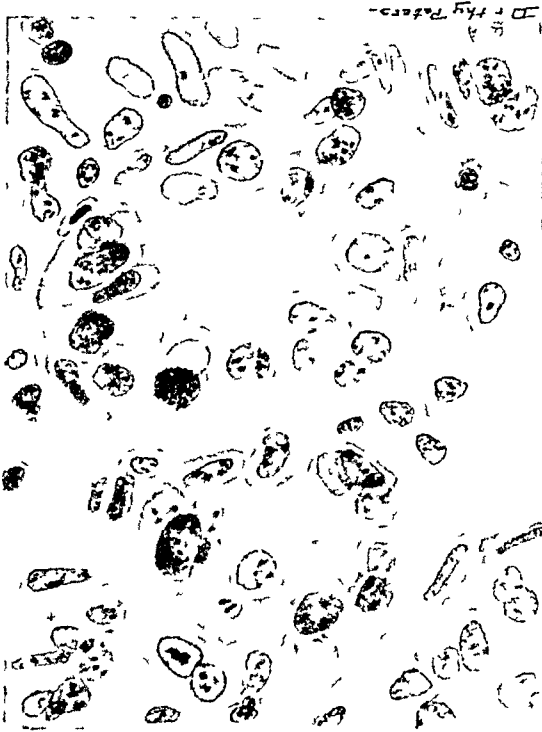


Fig 2

of the gall-bladder have been reported, no mention of a simultaneous penetration of this organ and of the right kidney has been made.

In the case herewith reported there was no suspicion of damage to the gall-bladder prior to the discovery of a large amount of bile in the peritoneal cavity. Examination then showed two orifices near its fundus through which the bullet had entered and had left that viscus. On the other hand, the previous withdrawal of blood and urine through the catheter indicated a laceration of some part of the urinary tract above the bladder, and further search disclosed an extensively torn right kidney invested in a large retroperitoneal hæmatoma. The subsequent careful routine examination, so important in all penetrating wounds of the abdomen, revealed only a grazing of the hepatic flexure of the colon without penetration of its cavity.

The treatment of penetrating wounds of the kidney has been both conservative and radical. Of the sixteen cases reported by Clémens three were treated expectantly with one recovery and two deaths. In the case that recovered the diagnosis was made by the presence of a punctured wound in the lumbar region associated with hæmaturia, in the two cases that died the damaged kidney was found on autopsy. In one of these cases the peritoneal cavity was found filled with clots, death having followed a sudden effort three days after the injury had been received, during which time the patient's general condition had been excellent. This same clinical course has occurred in rupture of other viscera, notably of the liver and spleen and one instance of rupture of the ileum without hemorrhage was reported by the writer some years ago. Such unfortunate accidents in connection with traumatic conditions of the abdomen point very strongly the moral that immediate exploration is warranted when the physical signs indicate the possibility of rupture, even though the general condition of the patient is such as not to excite apprehension.

Of the remaining 13 cases five were treated by tampon, in three of which the kidney perforation was the sole lesion,

nosis and has diminished the frequency of error. On the other hand, the study of the modification of any special lesion by either some form of pre-existing infection or *vice versa*, is still in a stage of early investigation. Thus, for example, what change if any could be expected in tubercular cervical lymph-nodes in the event of syphilitic infection, or does syphilitic infection modify either the lesion or the clinical course of pre-existing malignant disease?

It is, however, to the last group of cases, in which the diagnosis is obscured by the coexistence of two or more entirely distinct lesions in adjacent organs, that the writer wishes to call attention and as the field is necessarily a broad one, the scope of inquiry will be limited to the consideration of coexisting lesions of the right kidney and gall-bladder.

Coexisting lesions of these organs, the result of trauma, are necessarily simultaneous. This is equally true of subcutaneous rupture as well as of penetrating wounds. In cases of the latter character the clinical picture is of interest in that symptoms arising from injury to one viscus may be partially or completely obscured by those arising from injury to the other. The uncertainty of diagnosis may be still further increased by the involvement of additional adjacent viscera and the actual nature and extent of the injuries may be ascertained only after making an exploratory incision. In the case of the kidney, while subcutaneous rupture is usually limited to that organ, its close relation to adjacent viscera accounts for the fact that, in penetrating wounds, one or more of these structures are injured as well. In a careful search of the literature 25 cases of pistol shot wound of the kidney were collected in a majority of which some additional viscus had been torn or penetrated. These included the pleura and diaphragm, the cardiac end and other parts of the stomach, the duodenum, the ileum, the colon, the splenic vessels and of the solid viscera, the pancreas and the liver. That the gall-bladder ordinarily escapes is not surprising in view of its protection by the liver, the costal margin, its considerable mobility, and its usually flaccid condition. While several cases of penetrating wound

It is in such a case as this that the painting of the part over the entire circumference will prove of value as it will allow of through-and-through projection of the shadow from a fixed point on one surface to a fixed point on the other

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- ⁵ Reichmann, M Surgery, Gyn and Obstetrics, Chicago, vol xiv, p 262, 1912

while in the remaining two, one was complicated by a wound of the diaphragm and pleura and the other by two perforations of the duodenum and ileum which were sutured. All five cases recovered. In two other cases the kidney laceration was treated by suture. Both of these were complicated by a wound of the liver and in one the colon was perforated as well. The last mentioned case recovered, the former died. The remaining 6 cases were treated by nephrectomy. Of these, two were without complications, with one recovery and one death, and four were complicated with wounds or perforations of other viscera. Of these, two recovered and two died. Taking the 16 cases together, 10 recovered and 6 died, recovery being largely favored by prompt interference.

While the total number of cases is entirely inadequate to serve as a basis for the formulation of the most desirable method of treatment, the advisability of exploration should at least be emphasized. If the bullet has entered the anterior abdominal wall this warning, for reasons already stated, is superfluous. In no instance would conservatism be warranted. If, on the other hand, the bullet has penetrated the lumbar region, the exposure of the kidney can be made with little risk and can be followed by nephrectomy when the kidney tissue or its pedicle is badly torn, or by tampon or suture when the laceration is not extensive. The ascending colon can then be examined and any perforation, if such exist, may be closed. If the bullet has penetrated the peritoneal cavity, further exploration and all necessary treatment is preferably made through an anterior incision.

In a search of the literature no cases of coexisting penetrating wounds of the gall-bladder and kidney were found. Two cases, however, have been reported by Frank and Wiewiorowski respectively, in which the gall-bladder had been penetrated by a bullet. In Frank's case no other lesion was found, while in Wiewiorowski's case there was, in addition, an orifice in and near the anterior border of the liver. Both of these cases are of interest in that they show that pronounced symptoms may be expected in penetrating wounds of the gall-

one inch below the costal margin near the outer margin of the rectus muscle. There was marked hæmaturia together with the symptoms of peritoneal irritation both anteriorly and in the right flank. Four hours afterward, an opening along the margin of the right rectus disclosed a large amount of bile in the peritoneal cavity. The gall-bladder was very small, of healthy appearance, and presented near its fundus two openings through which the bullet had passed. The hepatic flexure of the colon was grazed. The right kidney was extensively lacerated and bleeding into both the peritoneal cavity and the retroperitoneal space. The gall-bladder and right kidney were removed and the abdomen closed tightly around a cigarette drain. Convalescence was complicated by suppuration in the perinephritic tissue which quickly yielded to a counteropening. Three years after the accident, the patient was in excellent condition.

Since the publication of Clémens' article, cases have been reported, several rather incompletely, by Wilson, Thorne, Walker, Kuster, and Keuper. In Wilson's report of 26 cases of gun-shot wounds of the abdomen, the kidney was injured in one instance, recovery ensuing. In Thorne's case the bullet entering anteriorly, penetrated the greater curvature of the stomach and the upper pole of the left kidney. The perforation of the stomach was closed and the peritoneum over the damaged kidney was sutured. This patient also recovered. Kuster reports three cases, all of which were treated conservatively. In the first the diagnosis was made by bloody urine persisting for 8 days after a bullet wound in the lumbar region which healed in 6 weeks, in the second the penetration of the bullet from the left hip to the right kidney region was followed by a urinary fistula which rapidly closed, in the third case an autopsy two and a half months after death from infection showed a healed wound in the convex border of the right kidney with the bullet in the liver. This case was said to have run its course without any symptom pointing to an injured kidney. In Walker's case, the bullet entering the right lumbar region passed through the lower pole of the right kidney and perforated the mesentery, filling the peritoneal cavity with blood. The kidney was sutured and the wound drained posteriorly. The patient made a tedious convalescence.

In Keuper's case, the bullet, entering the left mammary line below the costal border, penetrated the left kidney and the splenic vessel, which was badly torn and surrounded by an extensive hæmatoma. The kidney was removed and the damage to the splenic vessels necessitated also the sacrifice of the spleen. Drainage of both kidney and splenic areas, healing taking place by primary union.

Keuper's case is of special interest from the fact that prompt recovery followed a simultaneous splenectomy and

bladder even though no other viscus is involved and they illustrate as well an interesting method of dealing with the perforation. Brief abstracts of these cases follow.

Frank's Case—Location of wound one and a half inches below and one inch to the right of the ensiform. Bullet felt under the skin opposite the middle of the eleventh rib which it had fractured. The patient was in moderate collapse and had several attacks of hæmatemesis. The peritoneal cavity opened through a three inch vertical incision just to the left of the median line, and was filled with blood which seemed to come especially from the region of the gall-bladder. This organ was situated nearer than usual to the median line and presented in the line of the incision. A perforation near its fundus, bleeding freely, was closed with silk and reinforced with Lembert sutures. After the removal of the blood the abdomen was closed without drainage. Recovery.

Wiewiorowski's Case—Location of the wound beneath the costal margin in the mammary line. The symptoms included pain, rigidity, weak pulse and shallow respiration. Peritoneal cavity opened 7 hours after the accident contained much bile. A hole 3 cm. from the anterior border of the liver and a large perforation on the under side of the gall-bladder were closed, each with two sutures. Drainage for 8 days. Wound completely healed on the twelfth day. Recovery.

The closure of the perforation in both cases is in marked contrast to the cholecystectomy which treatment was adopted by the writer. In the case herewith reported the two openings in the fundus of the bladder were about one inch apart and could have been separately sutured or a satisfactory cholecystostomy could have been easily established. Which method of treatment is preferable cannot be determined, but at all events it is well to remember that if the condition of the patient requires haste, the simple closure of the perforation has given satisfactory results.

The report of the writer's case herewith follows with mere mention of the fact that there were no symptoms prior to the opening of the peritoneal cavity that suggested the damage to the gall-bladder. The symptoms of peritoneal irritation would naturally appear after any penetration of that cavity with no visceral involvement.

Male, twenty-five. Shot at 4 A.M. with a pistol of medium calibre, and brought to the Gouverneur Hospital. Examination revealed a small circular orifice in the upper right quadrant about

was intensified by movement from side to side. Neither during nor after cessation of the pain was any tenderness noticed. Shortly after the advent of the pain, patient suffered from attacks of coughing with the raising of small amounts of blood. There was no actual vomiting and the blood did not appear until some time after the coughing was first noticed. Four months ago, after the appearance of both the cough and the bloody expectoration, patient is said to have had an attack of pleuropneumonia and it was owing to the slow convalescence from this illness that she was recommended to the hospital for treatment. During this time as well as after her admission to the hospital patient suffered from a continuation of the epigastric pain and the persistent coughing, which together with a tendency to faint when getting out of bed, constituted her chief complaints. There has never been any symptom pointing to disturbance of the urinary tract. During the 6 months prior to her admission in the hospital patient has lost about 60 pounds.

Examination shows in the midline a rounded tumor, extending below to within one-half an inch of the umbilicus while its upper limit is not well-defined. Its surface is smooth, its consistency is firm and in its widest diameter is about four inches. It is slightly movable with respiration and from side to side. At the time of the first examination the right kidney was not "palpable," but later this organ could be made out. A clinical diagnosis of carcinoma, probably of the stomach, was made. This diagnosis seemed to be substantiated by the findings in the stomach. This organ contained a large amount of thick tenacious mucus and was cleaned with difficulty. There was no macroscopic blood. The analysis of the gastric contents showed a total acidity of 0.36 per cent, an absence of free hydrochloric acid, no lactic acid and a moderate reaction showing the presence of blood. A second analysis several days later yielded a similar result.

Routine examination of the urine showed a large amount of pus. This led to an investigation of the bladder by Dr. Osgood and it was found, that while the urine from the left kidney was normal, that from the right was very scanty and almost entirely purulent. An X-ray then taken disclosed the presence of a large calculus in the right kidney.

On subsequent examination the mass seemed to extend into the right hypochondrium and back toward the lumbar region, and

nephrectomy The damage to two such vascular organs must have caused very considerable hemorrhage and have diminished, relatively, the resistance of the patient

Through the courtesy of Drs Dennis and Keyes, the writer adds brief extracts of cases of gunshot wound of the kidney which were treated by these surgeons in St Vincent's Hospital

(1) Man of twenty, shot in the back and right hip and elbow There was hæmaturia for five days Owing to a rather rapid fall in blood-pressure after the accident, no operation was performed The patient made a good recovery (2) A second case in which the kidney and stomach were penetrated by a bullet Through a median laparotomy, the stomach was sutured No nephrectomy was necessary This patient also recovered

The consideration of coexisting lesions of the kidney and gall-bladder of a non-traumatic origin deals with an entirely different pathological group, in that the changes that occur in either organ are probably entirely independent of each other and do not develop simultaneously This leads to a confusing intermingling of subjective and objective symptoms, for while a distended gall-bladder is usually easily differentiated from an enlarged kidney, the coexistence of both conditions may modify the physical signs to such an extent as to make diagnosis extremely difficult Furthermore, this difficulty may be still further increased, especially in women, by the presence of a "Riedel" modification of the right lobe of the liver

The history that follows illustrates the possibility of error in diagnosis in coexisting lesions of these organs and emphasizes the importance of exploration in all doubtful abdominal cases even though the chances of benefit from such a procedure may be slight

E F, female, admitted to the service of Dr Thatcher, May 10, 1912 Past history negative Patient was always well until 6 months ago when she suffered from attacks of epigastric pain of a heavy, dull character, situated in the middle of the line and not affected either by respiration or by raising of the shoulders This pain came on directly after eating, lasting from one to two hours and relieved by taking hot water Occasionally the pain

operation for the distended gall-bladder which was felt unchanged 6 months after operation. She left the hospital.

Post-operative Notes—Five months after operation, patient was in very good condition. Both the pain and the cough had disappeared and she had regained some of her lost weight. The gall-bladder was still palpable, as at the time of her discharge from the hospital, but was not sensitive. Nineteen months after the operation patient had regained all her lost weight and was able to eat all kinds of food. She has never felt so well during the past five years as at present. On examination, the gall-bladder can no longer be felt. In its place there is a slight sense of resistance and the patient states that the only indication of the former trouble is the occurrence of slight occasional cramps in the gall-bladder region.

The most careful consideration of the history of this patient fails to disclose any symptom which could be ascribed to the condition of the gall-bladder. Therefore, it is impossible to say which lesion was primary. The changes in either organ indicated lesions of long standing. That the symptoms, of which the patient complained, were due to the renal calculus, is clearly demonstrated by their prompt and permanent disappearance when the kidney was removed. Even the pain, which in its location was much more significant of cholelithiasis than of a kidney stone, completely vanished. That in renal calculus, the pain is sometimes referred anteriorly, must be recognized by all. The writer some years ago called attention to this fact and cited instances of the occurrence of pain from renal stones anteriorly below the level of the navel and on the affected side. The present case is the first instance that he has observed of pain from the cause referred anteriorly to an area above the level of the navel, and, what is still more unusual, as pronounced on one side as on the other.

The fact that the patient lost over 50 pounds within six months is, at her time-of life, suggestive of malignancy. In her case, it was probably the result of her prolonged illness and of the associated "hectic" temperature. The diagnosis of cancer of the pylorus seemed plausible in view of the location of the tumor and of the results of the gastric analyses.

it was thought that the line of demarcation between it and the kidney could be demonstrated

The patient was anæmic, the general leucocytosis was 18,000, with a polymorphonuclear count of 79 per cent. A Wassermann reaction was negative.

During the next four weeks the patient ran an irregular temperature with evening exacerbations. While it was realized that under ordinary circumstances the calculus, together with the remnant of the right kidney should be removed, the propriety of this measure was questioned, in view of the fact that the patient, if suffering from extensive malignant disease, could scarcely hope for any permanent relief. Four weeks after admission to the medical ward, having been seen several times by the surgeon in consultation, she was transferred to the surgical side for operation which, in view of the doubtful diagnosis, seemed to be warranted. On examination at this time, it was realized that a part of the mass at least was due to the condition of the kidney but that a considerable portion situated more anteriorly could not be accounted for in this way.

Operation —Ether. The kidney was exposed through the lumbar route and was found to be extensively adherent to the investing perirenal fat. It was markedly lobulated, measuring 17 by 19 by 7 cm., its capsule non-adherent, its denuded surface finely granular. It presented multiple abscesses with a moderately distended pelvis which contained a large branched calculus extending into the dilated calices. There were several other calculi nearer the periphery of the organ. Microscopical examination showed a chronic suppurative nephritis with a calculous pyonephrosis (made by Dr. A. V. Whipple). The kidney was removed, the pedicle being divided between clamps to avoid soiling of the operative field. The peritoneal cavity was then opened along the outer margin of the colon. This permitted a thorough exploration of the region of the pylorus, the duodenum and the gall-bladder. This last-mentioned organ was found to be greatly distended and enlarged, and was presumably the site of a chronic cholecystitis. The pylorus, the adjacent part of the stomach, and the duodenum were normal. The peritoneal cavity was now sutured and the lumbar incision closed in the usual way with drainage. The patient made a prompt recovery but has hitherto refused to submit to

SPLENIC ANÆMIA WITH SPLENECTOMY (BANTI'S DISEASE)

A CASE REPORT, WITH REMARKS

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THE designation, Banti's disease, was made because beginning about 1883 a Florentine pathologist by that name made successive reports of a condition in which he found primary enlargement of the spleen with accompanying anæmia followed by cirrhosis and ascites. To this complete symptom complex the name was applied by Senator.¹ Although primary splenic enlargement with anæmia, but without known etiology, had been observed to occur, yet its causative action in the anæmia and hepatic cirrhosis was first conceived by Banti.

Previous to this several authors had suggested sub-division of the leukæmias, so that Banti's suggestion met with quite general approval. Since his work it has been definitely further agreed that there is a group of conditions between the leukæmias on the one hand and the cirrhotoses of the liver on the other, possessing some of the peculiarities of both conditions, yet distinct from them and with a distinct etiology.

The literature of the subject which has sprung up since 1883 is voluminous, has been well reviewed from time to time and from it may be gleaned the fact that our views of the cause and course of the group of splenomegalies are not at all clear and must be subject to frequent revision as the problems of normal and pathologic physiology are solved. The tendency at present is to divide this group into three divisions, viz splenic anæmia as distinguished by Osler,² Banti's disease and splenomegaly of the Gaucher type, regarding which latter disease a most excellent discussion by Brill and Mandlebaum appeared as below noted.¹⁴ Many authors consider, however, that splenic anæmia and Banti's disease are different phases

Had this condition actually existed, the size of the tumor would have indicated that it had probably reached an inoperable stage, in which event the removal of the calculus would have been of little value. On the other hand, in the absence of malignant disease, the removal of the calculus was clearly indicated. The fortunate intervention, carried out only after an exhaustive observation of the patient, must be ascribed to the fact that the physical signs were so obscure and in a measure so contradictory that only an exploration could unravel the mystery.

The fact that, at present, 19 months after the operation, the gall-bladder is no longer palpable, raises the question of whether the lesions of these two organs were accidental or whether, as a matter of fact, the gradual enlargement of the gall-bladder might not have resulted from the irritation due to the elimination of toxins arising from the chronic pyonephrosis. At the time of operation the condition of the gall-bladder seemed to justify a secondary cholecystectomy or cholecystostomy and the patient was so advised. The advice was repeated when, at the end of five months, the gall-bladder remained unchanged. At present, however, the fact that the gall-bladder can no longer be felt, seems to have rendered a second operation unnecessary unless there should be some subsequent exacerbation.

In conclusion the writer wishes to urge, in all doubtful conditions of the abdomen, the propriety of surgical exploration if by such means there is a chance, no matter how slight, of benefit to the patient.

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toxæmia may be due to unexcreted products of metabolism or to the same toxins which acted etiologically in the splenic enlargement, anæmia, etc

Some authors, especially Kartulis,¹ have described the occurrence of unexplained fever a few years before the onset of the condition

As to etiology the way is divided between malaria and lues and a search for some specific infection not yet described It is pretty generally conceded that the spleen is the primary seat of the disease, but whether such known agents as malaria, lues, kala agar, torsion of the pedicle, present all the causes, or whether a distinct etiologically unknown group exists is clearly stated but by a few authors

As to treatment, splenectomy as early as possible, in fact, at any stage in which the patient can stand the operation, has been amply shown to be of the greatest benefit The following case report will be of interest and is placed on record as a study of the condition

Clinical Report—The patient was a Polish woman, married, thirty-three years of age, father dead at forty-five years from injury, mother dead at seventy-three years of some condition producing dropsy She has three brothers and two sisters living and well There have been no tumors, nor recurrent diseases in the family history She has three children living and well, the youngest one year old, has lost one of imperforate anus and one of summer diarrhœa, has had no miscarriages

She has always lived as a working woman in this country, doing housecleaning, washing, etc She has never used alcohol nor tobacco

As a child she had no illnesses Menses first occurred at 18 years, skipped two months, regular and without pain since She has not menstruated for the past year since the birth of her last child, which was normal She has never had malaria, typhoid nor any other acute infection At 15 years of age she had some acute fever in which she was delirious, lasting two weeks

Present Illness—Five years ago she first noticed enlargement of the abdomen and felt a tumor of the left side between the ribs and the ileum, which has gradually increased and on account of which she comes There has been some shortness of breath, grad-

of the same condition and that such a case originates with enlarged spleen and anæmia as the early symptoms and terminates with cirrhosis and ascites or some secondary hepatic condition. The so-called Gaucher type, of French origin, comprises a small number of cases with hereditary tendency in which primary endotheliomatous growths occur in the spleen and metastasize to the splenic and portal veins and the liver.

As Klemperer³ suggests, the name splenic anæmia seems preferable to that of Banti's disease and less liable to confusion. Such a name has a definite significance, being a necessary step toward a clear understanding of the subject.

For clinical study and especially diagnosis, three stages must be kept in mind, first, characterized by malaise, weakness, possibly repeated nausea, indefinite soreness in the splenic region, slight anæmia, lasting periodically from ten to fifteen years, occurring in young adults, the second stage that of splenic enlargement with urine scanty and dark colored, pigmented skin, diarrhoea, hemorrhages, lasting a few months to two years, the third stage that of hepatic enlargement, ascites with the other signs accentuated and terminating by cachexia, intercurrent diseases or exhaustion.

Death in one of the writer's cases of splenic enlargement was due to uræmic coma, with scanty urine, developing after eighteen months of repeated, rapid reaccumulation of ascites. The urine was progressively scanty, high colored, with but a faint trace of albumin and no casts. Post mortem, the kidneys were in excellent condition and certainly not a primary cause of the uræmia. It seems probable, therefore, that some factor other than renal disease was the cause of the fatal coma.

The ascites recurred in from seven to twenty-eight days for thirteen months, requiring twenty-nine tappings of from ten to twelve litres each. Such a condition must result in a disturbance of the normal circulatory balance in which an increased volume of blood goes to the peritoneal surface and by a progressive reduction of the fluid contents of the body insufficient water is present to carry on the normal body metabolism and excretion. This is evidenced by the progressively scanty urine which in other respects may be normal. The resulting

ual increase of weakness, very slight pain over the tumor, but has continued at her work daily. There have been no stomach signs, no vomiting, no distress, no loss of appetite and no eructations. She has had no signs referable to the urinary organs, no pain, no colic and no increased frequency, no hæmaturia, urine free. She has had no cough, no fainting, no dizziness, no pain in chest, no signs referable to the cardiovascular system. She has had no œdema, no eruption, no skin lesions of any kind except pigmentation as stated below.

Examination showed a fairly well nourished, slightly jaundiced woman of medium build, weight 138 pounds. The jaundice is apparent in the sclera only. Her skin presented a peculiar swarthy or brownish tinge equally distributed over the body. Mucous membranes and cheeks good color. The chest was negative to examination, except the heart, which showed some left hypertrophy. Temperature 98°, pulse 74, respiration 18. Abdomen rounded, full, largest circumference below the navel, muscles greatly atrophied and relaxed, recti diastased. Skin much wrinkled, peculiarly dry, harsh and pigmented brown. Liver upper border 6-7-10th spaces, lower border palpable, sharp, firm, slightly tender, two fingers below the ribs and across the epigastrium. In the gall-bladder region could be felt two or three firm nodules the size of a hickory nut on its edge. The surface of the liver was felt to be rough. The spleen extended from the eighth space to the crest of the ileum and to within two inches of the median line. It was firm, smooth, and not tender. On its anterior edge could be felt two notches, the lower deeper than the upper. The whole spleen was very mobile and could be pushed about on the left side of the abdomen. No bruit could be heard over it. Kidneys: neither palpable nor tender.

Blood count before operation, June 24, 1913, red blood cells 4,900,000, white blood cells 4000, hæmoglobin 80 per cent.

July 18, 1913, red blood cells 4,500,000, white blood cells 3500, hæmoglobin 80 per cent, percentage of red blood cells 90, color index 9.

Differential count, large mononuclears 16.3 per cent, small mononuclears 15.1 per cent, polymorphonuclears 63.5 per cent, transitionals 4.2 per cent, eosinophiles 4 per cent, mast 5 per cent.

The red cells showed no marked variations in size. There were no nucleated reds. Poikilocytosis moderate. Central pale

PNEUMOCOCCIC ARTHRITIS.

BY KENNETH BULKLEY, M D.,

OF NEW YORK

PNEUMOCOCCIC arthritis is a comparatively rare disease. Were it not for this fact we would feel some hesitancy in writing a paper following but one observation. However, in attempting to obtain data, we found that the statistics given were somewhat misleading, due no doubt to the compilation of a relatively small number of cases. This led us to review the cases already collected and to collect such additional as were available, including, as far as possible, only those cases in which the arthritis was proved to be due to the pneumococcus. For this reason a number of reports found in previous compilations will be found missing from this paper.

The excuse for this paper and the material on which it is based consists of reports of 172 cases collected from the literature to which we have added one case coming under our own observation. The history of this case is as follows:

J. B., male, age eleven months, fourth child. Normal birth, breast fed for three months. Well until 4½ weeks ago when he developed a left lower lobe pneumonia. During the course of this pneumonia the right shoulder became somewhat swollen and tender. The swelling increased slowly until three days before admission, but since then the increase has been rapid.

Patient admitted to the Presbyterian Hospital, where he was first seen by the writer, on March 28, 1911. Examination showed a poorly nourished child, otherwise apparently healthy except for the local condition. At the site of the right shoulder was a rounded swelling occupying largely the anterior and lateral aspect of the joint. Skin over it white, but numerous large dilated veins were evident. Swelling was about the size of a mandarin orange, soft, fluctuating, and moderately tender. No crepitus. Length of arm normal. Motion of arm limited apparently by pain. Temperature 101.2°, pulse 142, respiration 24. Leucocytes 34,500.

Ninth day 960 c c , 10 grammes total nitrogen, 7.2 per cent ammonia nitrogen

Seventeenth day 930 c c , 4.3 grammes nitrogen, ammonia nitrogen 7.8 per cent total nitrogen

Six weeks after operation urine was normal in every way, specific gravity 1010, acid, albumin and sugar negative and pale amber in color

Umber⁵ has reported a study of the nitrogen excretion in two cases of Banti's disease with splenectomy. In both cases he reports an increased nitrogen loss with a constant intake, body weight stationary. After splenectomy the nitrogen exchange became normal and there was a slight gain in weight. He believes the toxic factor is removed with the spleen.

In neither of Umber's cases was the characteristic blood picture of Banti's disease present, there being a slight leucocytosis instead of a leucopænia and the marked post-operative leucocytosis almost universally reported did not occur. The nitrogen output of the above case was normal, as well as the proportion of ammonia nitrogen, both before and after operation. This coincides with Stengel's opinion,⁶ *ie*, "Disturbed metabolism is a feature common to other conditions allied to Banti's disease and probably in Banti's disease it is merely a phase in its course."

Surgical Report—Patient operated on July 22, ether anæsthesia, iodine preparation. Vertical incision through the left semilunaris four inches long. There was a slight amount of fluid in the abdomen, peritoneum was markedly thickened, the pelvic organs were negative, both kidneys were palpable and of normal size. Stomach normal. The liver—left lobe showed a very marked, finely granular cirrhosis. The same condition was felt in the right lobe, and the nodules which had been palpated on the edge of the liver were found to be due to contracted bands of fibrous tissue. The gall-bladder empties on pressure.

The lower end of the spleen was first delivered and rolled out away from the operator, the vessels being caught as they came into view. The spleen was exceptionally long, tongue-like in shape and showed four points at which large vessels entered. The vessels were caught with rubber-guarded clamps to prevent tearing of the very delicate veins. Some difficulty was experienced in separating the spleen from the diaphragm to which it was adherent. Ligation with silk. Closure with plain gut, chromic gut on the aponeurosis and silkworm. Duration of operation forty minutes.

area was slightly increased. A moderate anæmia of the chlorotic type, with a marked leucopænia. Wassermann reaction was negative, one test.

Diagnosis—Primary splenic anæmia. July 22, 1913. Splenectomy.

On the 23rd the blood count showed red blood cells 4,000,000, white blood cells 7200, hæmoglobin 80 per cent, percentage of red blood cells 80, color index 1. The differential count showed large mononuclears 5 per cent, small mononuclears 33.3 per cent, polymorphonuclears 56.6 per cent, transitionals 1.6 per cent, eosinophiles 2.5 per cent, mast 9 per cent.

The blood picture varies from that before operation in there being after operation a larger number of white cells present and an increase of small mononuclear lymphocytes at the expense of the polymorphonuclear cells, a relative lymphocytosis. The red cells show some slight variation in size as before, but the central pale area is a little more marked, poikilocytosis is the same as before operation. There is an occasional nucleated red cell of the normoblastic type.

July 27, 1913, red blood cells 4,800,000, white blood cells 13,300, hæmoglobin 90 per cent.

Urine. The urine was persistently scanty both before and after operation. For the twenty-four hours preceding operation (the patient had had a cathartic two days before) it was 1000 c c, dark amber, clear, specific gravity 1013, acid, albumin a trace, sugar none present, contained a few leucocytes, bladder epithelia, no casts, many oxalate crystals and amorphous urates. Total nitrogen 5.96 grammes, ammonia nitrogen 6.5 per cent of the total nitrogen.

The twenty-four hours following operation 870 c c. Specific gravity 1032, strongly acid, dark amber color, heavy precipitate of urates, albumin a trace—less than before operation, sugar none. Total nitrogen was 12.3 grammes, ammonia nitrogen 5 per cent of the total nitrogen.

Sixth day after operation 1140 c c. Total nitrogen 13.9 grammes, ammonia nitrogen 4.5 per cent.

Seventh day 2050 c c. Patient has drunk very heavily of water and this is the only time either before or after operation that the urine was above the average in quantity and contained 14.87 grammes total nitrogen, 6.3 per cent ammonia nitrogen. Following this the urine persistently stayed at less than 1000 c c.

The peritoneum is considerably thickened and exhibits hyaline degeneration

The points to which I wish to draw attention in this case report are the unexplained fever a number of years before, the absence of malaria, lues or an alcoholic habit, the development of primary splenic enlargement, the leucopænia before operation, the leucocytosis after operation of a lymphocytic type (*cf* 1, 7, 8), and the marked improvement of the patient after splenectomy, the endothelial proliferation approaching that seen in the Gaucher type of splenomegaly

Later observations, August 30, red blood cells, 5,200,000, white blood cells, 12,000, hæmoglobin, 95 per cent

The anæmia has rapidly been corrected The leucocytosis was due to the relative lymphocytosis as in the other counts after operation It has required as long as five years for the re-establishment of the normal differential leucocyte count in cases reported by Banti, Senator, Wolff

I am greatly indebted to Dr E P Neary of Charity Hospital resident staff for most careful blood counts, to Dr H H Haskins, Associate Professor of Organic Chemistry, W R U, for urine analyses, and to Dr J D Pilcher of W R U for his report on the pathology of the specimens I shall be pleased to furnish a rather extensive bibliography to anyone desiring it

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Pulse 94, respiration 16 The pulse promptly dropped to 76 after operation On the following day the patient showed a rise in temperature to $101\frac{3}{5}^{\circ}$, pulse 72 This, however, subsided on the same night, and from thence on the temperature continued between 99° and 100° , finally remaining at 98 and a fraction after the ninth day

Pathological Report—A spleen, weight three pounds, $10\frac{3}{4} \times 4\frac{3}{4} \times 1\frac{3}{4}$ inches The capsule is thickened, surface slightly roughened, of a bluish-gray color On the concave surface are four points of entrance of large vessels two inches apart Consistency unusually firm both to pressure and to the knife, cut surface beef-like in color, abnormally dry Very little pulp can be scraped off with a knife No malpighian bodies are visible The veins are somewhat thickened

Microscopically the characteristic feature of the spleen is the very marked endothelial proliferation This has progressed to such an extent that there is very little pulp left The endothelial cells of all the lymph sinuses, the capillaries and the blood-vessels are greatly swollen The sinuses in places are apparently obliterated, and in such areas there is almost complete absence of the pulp cells, an occasional lymphocyte is found in the capillaries In other areas the process is less marked and the lymphocytes are more numerous There are occasional polymorphonuclear cells and eosinophilic cells present

The endothelial cells of the capillaries and smaller vessels are frequently so greatly enlarged as practically to occlude the vessel lumen The larger vessels also show this change together with thickening of the vessel wall

The malpighian corpuscles are diminished very considerably in size, probably to one-half or one-third the normal The central part of the corpuscle has not the usual looseness of structure but seems to be more compact, the lymphocytes lying more closely together and the supporting cells are unusually visible The periphery of the corpuscle has the characteristic endothelial proliferation The artery of the corpuscle also shows the thickened endothelium and wall

As would be expected from the unusually firm consistency of the gross specimen, there is increase in the connective tissue of the organ The capsule is roughly three times the normal thickness, the trabeculae are increased in size, the interstitial tissue in the pulp has also proliferated considerably Throughout the organ are small granules of brownish pigment The capillaries and connective tissue in the trabeculae contain considerable of this pigment

In conclusion the characteristic feature of the spleen is the marked hypertrophy and hyperplasia of the endothelial structures, with very great diminution in the pulp substance and decrease in size of the malpighian corpuscles

The liver section shows marked fibrous tissue proliferation confined to the interlobular structures, forming a multilobular cirrhosis The intra-lobular connective tissue and the liver cells present nothing abnormal

neglected field of abdominal surgery that we decided to report our cases. And we were the more prompted to do so by the fact that we were unable to find a single monograph by either an English or American surgeon on this topic. Most of our cases were operated upon in Dr Lilienthal's service at Mt Sinai Hospital since 1906. Before 1906 the cases were rarely recognized, and our records are not as accessible or as complete before that date.

In spite of the fact that the ileocæcal region is one of the sites of election for intestinal tuberculosis, but little has been written on the subject, and our text-books almost ignore it. This we believe is at least in part due to the difficulty in making the diagnosis at operation, or even by the pathologist. Many of these cases, perhaps most of them, come to operation with the diagnosis of appendicitis. We find an inflammatory tumor which the pathologist usually reports as "chronic inflammation." We remove the appendix, sometimes a fecal fistula develops, which we close at a subsequent operation. Every surgeon sees such cases and puts them down as cases of appendicitis. In some of them there is a tubercular ulcer inside of the appendix or cæcum, with an inflammatory exudate around the intestine. If we remove some or all of this exudate, the pathologist is quite right in calling it inflammatory. If we ask for serial sections through the appendix or cæcum (if it was removed) then often a small tubercular ulcer will be found, and the diagnosis cleared up. The first case that the writer encountered was a case of this kind. At the first operation the greater part of a large inflammatory tumor around the cæcum was removed, and on section was pronounced chronic inflammation. At a subsequent operation, more of the tumor and the greater part of the appendix were removed, and again pronounced chronic inflammation. At a third operation for the closure of a fecal fistula, the stump of the appendix was removed and again the report came back chronic inflammation. We requested that more sections be made and finally a typical tubercular ulcer was found in the appendix and the diagnosis was established. Since then the writer has frequently seen similar cases, but in

ILEOCÆCAL TUBERCULOSIS

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OUR knowledge of this subject really dates from 1891, in which year Billroth in Vienna, and Hartmann and Pilliet in Paris, simultaneously insisted on the fact that tubercular lesions existed in the cæcum, lesions which had before then been taken for carcinoma. Since then we have found out that the cæcum is more frequently the seat of tuberculosis than any other part of the alimentary tract. Both sexes are equally affected, one observer reported 36 males and 42 females, and another 48 males and 35 females. It is found oftenest between the ages of twenty and forty years. Clinically there are two sets of symptoms, first, those of peritoneal reaction, and second, those of intestinal stricture. As the disease, when left to itself, is always fatal, operation is indicated in all cases.

Thirteen years ago the writer was fortunate enough to operate on a very complicated case, which finally turned out to be an ileocæcal tuberculosis. Ever since then he has been on the lookout for these cases, and has succeeded in recognizing about ten others at operation. No doubt some others were overlooked or were operated on as cases of appendicitis. Cases of simple tubercular ulcers in the appendix are not included in this paper. We believe that these cases of ileocæcal tuberculosis are not so rare as the scarcity of the literature would make us believe. They are often mistaken for cases of appendicitis with inflammatory exudates. We have several times operated on such cases but were unable to get a positive diagnosis of tuberculosis from the material removed, although we felt quite sure that we had to deal clinically with tuberculosis.

It was in the hope of throwing some light on this rather

* Read before the Surgical Section of the New York Academy of Medicine

later she developed an acute pulmonary tuberculosis, from which she died. The tubercle bacilli get into the intestine either with food or drink, or are swallowed with the sputum.

A tubercular ulcer in the appendix will not always give symptoms. In one hundred consecutive autopsies of cases that died of tuberculosis, Sonnenburg found two cases of tuberculosis of the appendix which had given no symptoms.

Preexisting ileocæcal disease is a predisposing factor to the development of ileocæcal tuberculosis, *e g*, the swallowing of tubercular sputum infecting a preexisting ulcer of appendix or cæcum. But even in cases without pulmonary tuberculosis repeated inflammation of the appendix will leave damaged tissues which are prone to tubercular infection. That these preexisting inflammations in the appendix and cæcum play a rôle is proven by Hartmann, who found that in eighty-five per cent of all intestinal tuberculosis the ileocæcal region was affected. In nine per cent of the cases only the ileocæcum was affected. Anatomic relations no doubt also play a rôle. In the small intestine the fecal current is pretty active and the bacilli are carried along rapidly by the stream. But when they enter the cæcum there is a marked slowing of the current, which suddenly is deflected to a right angle, and then travels uphill. This gives the bacilli an opportunity to become lodged, either on a preexisting ulcer, or in one or other of the lymph follicles, which, especially in children, are very abundant in this region. Another source of infection is the mesenteric glands in the vicinity of the ileocæcum. From them a retrograde infection of a preexisting cæcal ulcer can take place.

Pathology—In the enteroperitoneal tuberculosis of the cæcum we first find tubercles in the mucous membrane surrounded by an inflammatory zone. These tubercles coalesce and form a flat ulcer with undermined edges. If such ulcers heal they produce more or less stenosis. As the process progresses tubercles develop on the serosa, and through these lymphatics become infected. As a result of the inflammation there is an adhesive peritonitis and the neighboring loops of small and large intestine become adherent to one another and to the

very few could the diagnosis of tuberculosis be substantiated by the microscope. We must not forget that in most of these cases the cæcum is not removed and the tubercular focus is often inside of the cæcum.

The most practical classification of these cases was made by Hartmann. He distinguishes two classes of cases. First, ulcerative enteroperitoneal tuberculosis of the cæcum, second, hypertrophic cæcal tuberculosis, the so-called ileocæcal tubercular tumor.

In class one we find either ulceration with perforation and abscess formation, in which case the disease is serious and hard to cure, especially as fecal fistula often develops, or, we find ulceration with stenosis, and frequently adhesions to the adjoining viscera or to the parietal peritoneum.

Class two is the chronic form to which attention was drawn by Billroth, Czerny, Terrier, and Hartmann. These cases usually present a palpable tumor, often of considerable size. The neighboring lymph-glands are usually enlarged.

Etiology —Is the disease primary or secondary? Conrath believes that in children we do find it as a primary lesion, but that in adults it very rarely is. Hartmann, Baum and others, on the contrary, believe that it often is a primary disease. Tomita, likewise, reports four cases in which the lungs and other organs were sound. This was true in at least three of our cases. In seven cases, Baum twice found a slight pulmonary tuberculosis, and in one case a tubercular peritonitis and an advanced pulmonary process. Campiche collected 279 cases and in less than one-third was there a pulmonary lesion, and ten per cent had extensive intestinal and peritoneal tuberculosis. Now is it fair to assume that the ileocæcal lesion is secondary because there is a slight pulmonary tuberculosis? It is even possible, in some cases, that the pulmonary lesion may be secondary to the ileocæcal lesion. I myself saw such a case at the very beginning of my medical career. The patient, a lady of about forty years, had always been well until she developed an ileocæcal tuberculosis. The appendix was removed and the abscess drained, but the wound did not heal, and six months

polymorphonuclears 78 per cent Cultures from throat showed staphylococci and pneumococci

On the day after admission the shoulder-joint was aspirated and 130 c c of greenish-white creamy pus was obtained Cultures from this showed a *pure growth of pneumococcus* The joint was again aspirated on the following day, and 2 per cent formalin in glycerin injected As the child was becoming progressively worse, temperature 104°, an arthrotomy under cocaine was done on the anterior aspect of the joint, and considerable pus and fibrin were obtained The structures within the joint felt normal to the palpating finger The accompanying temperature chart shows the

FIG 1

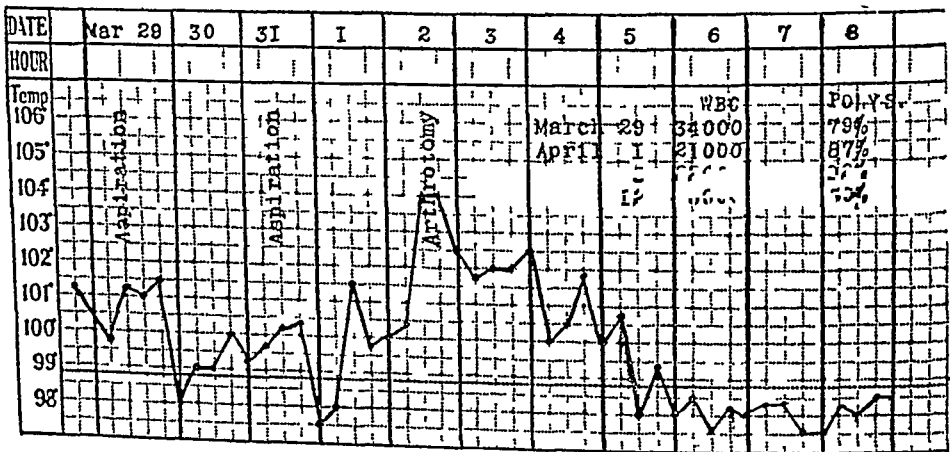


Chart of author's case Note sudden fall of temperature after each aspiration and the rapid permanent fall after arthrotomy

course of the disease The drainage, at first profuse, gradually decreased, and on the eighth day the rubber drainage tubes were removed Convalescence was uneventful and the wound rapidly closed Some months later function was perfect and no limitation of active or passive motion could be detected

Historical Note—The pneumococcus was first discovered by Sternberg in 1880 In 1881 Volpian again described it in the sputum, and in the same year Ebert and Koch and in the following year Friedlander, Leyden, and Gunther showed it to be constantly present in the lungs of persons dying with lobar pneumonia It was not until 1884 that Talmon first successfully isolated it in pure culture on artificial media In the fol-

parietal peritoneum, and thus a palpable tumor may result. In this way the disease may be limited to the affected area. In other cases there is a cheesy degeneration of the tubercles and an abscess develops. In some cases the ulcer of the mucous membrane spreads through the muscular and serous coats, causing a perforation of the intestine, and a resulting abscess. This is the pathological picture in the enteroperitoneal or ulcerative cases.

In the cases of tubercular ileocæcal tumor, the process is more localized and spreads upward along the cæcum, whereas in the ulcerative cases the ileum is more affected. There is no cheesy degeneration, not much ulceration, but an enormous production of connective tissue. The cæcum is the seat of a firm fibrous tumor, with which the appendix is usually intimately connected. The hypertrophy involves all three coats of the intestine. The serosa often shows no signs of tuberculosis, the mucous membrane is the seat of ulceration, although the tumor can develop without ulceration of the mucous membrane. There is regularly stenosis of the lumen. Adhesions to the parietal peritoneum come only late in the disease. This free mobility is an important sign in the differential diagnosis. The slight or absent cheesy degeneration, the difficulty in finding tubercle bacilli in the microscopic sections, would lead us to believe that few and not very virulent bacilli cause the disease. The chronicity of the disease, likewise, speaks for this. The enormous connective tissue formation is so uncharacteristic of tuberculosis that some authors have doubted it. But there are other tubercular lesions which resemble it. Langhans was the first to point out the similarity to hypertrophic forms of lupus. Here also we have a slowly progressing disease, with extensive cellular exudate, replaced in time by scar tissue, and in lupus also we find few tubercle bacilli.

Symptoms —1 *Enteroperitoneal form*. The symptoms are not characteristic. There is gradual increasing pain in the right iliac fossa lasting several months, later, nausea, vomiting, and belching. At times we find a slight evening temperature, loss of weight, and sometimes diarrhoea with blood and mucus.

tion, certainly not so early in the disease. The pain is not so severe, and the tumor is more apt to be fixed. Salzer states that if in a given case we find a long-standing stenosis of the gut with a freely movable tumor, the diagnosis is tuberculosis and not carcinoma. In tuberculosis the tumor is more apt to be smooth, in carcinoma nodular. In children we must also differentiate from ileocæcal intussusception, especially the chronic form.

Treatment —1 Artificial anus formation 2 Complete intestinal exclusion 3 Ileocolostomy, with or without intestinal exclusion 4 Partial or complete excision of cæcum and ileum

The removal of the appendix is indicated in practically every case.

1 *Artificial Anus Formation* —This is rarely indicated, and then only as a temporary expedient in desperate cases, to be followed later by a lateral anastomosis or an excision. Statistics show that 83 per cent of these artificial anus cases die.

2 *Complete Intestinal Exclusion* —This operation was performed in a few of these cases, but it would very rarely be indicated to-day.

3 *Ileocolostomy, with or without Intestinal Exclusion* —This simple operation, with a low mortality rate, will cure a large number of our cases. We have been accustomed to do it by the same technic that we employ in doing a Moynihan gastro-enterostomy, using clamps and linen sutures. The ileum and cæcum, at least three inches away from the diseased area, are approximated without tension. Clamps are applied as in doing a gastro-enterostomy, and a posterior continuous serous suture is applied. The intestine is then opened, the redundant mucous membrane excised, and the interior of the gut is carefully swabbed out with alcohol. A running continuous suture (Connell) quickly closes the intestinal canal. This suture passes through all the coats of the gut and the knot is on the inside. The clamps are now removed and if there is any leakage (which there should not be) one or two reinforcing sutures of linen are applied. The posterior continuous serous suture, which had been left long, is now continued anteriorly as a serous suture,

After a certain time a mass is felt, it is usually hard and not sharply defined

2 Ileocæcal tubercular tumor At first the symptoms are similar to those found in the enteroperitoneal form The patient sometimes dates the onset of the disease to a trauma, there is either diarrhœa, or alternating obstipation and diarrhœa This by some authors is considered a characteristic symptom Later there is a stricture of the gut, and then we find severe colic The writer recently operated on a case of this kind, in which the first symptoms were those of intestinal obstruction There had been no preexisting symptoms referable to the intestine Usually the colic at first is mild and then gradually increases in severity As many as ten attacks have been noted in one day Later we find vomiting, chills, fever, meteorism, and intestinal peristalsis becomes visible; in other words the picture of intestinal obstruction In the right iliac fossa a tumor of considerable size can be felt, it is not very tender to the touch and is regularly freely movable By distending the colon through the introduction of air into the rectum, the tumor can be made to approach closer to the abdominal wall, and can then be more easily palpated According to Conrath the average duration of the hypertrophic cases is two and a half to three years, although it is hard to state exactly when the disease started But we do know that it is a chronic disease, in the absence of complications, and that the patients, if not operated upon, die after a long time, either of cachexia, pulmonary or intestinal and peritoneal tuberculosis

Diagnosis —1 Enteroperitoneal form It is very difficult, if not impossible, in many cases to differentiate it from appendicitis If the general condition is very poor, or if there are sweats or persistent diarrhœa, the diagnosis is easier

2 The hypertrophic form In the early stages it resembles very much the ulcerative form and the diagnosis is very difficult, not to mention again the similarity to appendicitis But we must also differentiate it from malignant neoplasms In carcinoma we do not find the symptoms of intestinal obstruc-

along these lines we will cure many of these cases by the first operation, and with a very low mortality rate. Whereas the intestinal resection, whether done at one or two sittings, will always give a high mortality. If the resection is done at the first operation, not only will the mortality be very high but we will sometimes be doing a resection where a lateral anastomosis alone might bring about a cure. Hartmann, in 1907, advised intestinal resection in the hypertrophic form, together with the removal of the glands in the ileocaecal angle. Where there is an extensive mass of adhesions and the resection in consequence is too dangerous, he advises intestinal exclusion. Alglave collected 50 cases of resection of ileum and caecum with 7 deaths, a mortality of about 14 per cent. We believe that if all cases were reported, the mortality from primary resections would be considerably higher.

Breiger, in his excellent Inaugural Dissertation, collected 27 cases operated by resection, from 1905 to 1909. The operation showed a mortality of 15 per cent. Campiche, who collected the cases prior to 1905, found an operative mortality following resection of over 20 per cent, *i.e.*, of 154 cases of resection 34.41 per cent were cured permanently, 20.12 per cent died shortly after the operation, and 13.63 per cent died of the disease at a later period. In this same list of Campiche we find 35 cases of lateral anastomosis with partial intestinal exclusion, with an operative mortality of 11.43 per cent, a later mortality of 25.7 per cent and 45.7 per cent permanently cured. In other words, not only does the lateral anastomosis give a very much lower mortality than resection (about half) but the percentage of permanent cures after the lateral anastomosis is also greater. Of course we must not lose sight of the fact that the lateral anastomosis was probably done oftener in the earlier cases, and the resections in the more extensive cases. But even taking this into account, for the reasons given above, we firmly believe that the lateral anastomosis, with or without intestinal exclusion, should be our operation of choice in the large majority of our cases. And we must not forget that these patients come to us in none too good condition. We usually find marked anaemia, loss of weight, often subacute intestinal

covering the through and through suture completely. If there was no abscess, after removing the appendix, the abdomen is closed without drainage. The anastomosis should be made far enough away from the diseased area to allow, if necessary, of a subsequent resection of gut. If desired, this lateral anastomosis can be combined with an intestinal exclusion. This would be indicated in cases involving a large part of the ileum and ascending colon. But in many of the cases the anastomosis alone will bring about a cure. Alglave collected 29 cases of lateral anastomosis (in some cases with intentional formation of a temporary fecal fistula) with 27 recoveries, a mortality of less than 7 per cent. The mortality after intestinal resection is more than twice as high. In desperate cases a simple incision and drainage, perhaps with the removal of the appendix, will be life-saving, and a lateral anastomosis can be done at a later sitting. If the disease is extensive, the operation advocated by Lane for severe cases of atony of the colon can be done. The ileum is divided, both ends closed, and a side-to-side ileocolostomy or ileosigmoidostomy done. In this way part of the ileum, the cæcum, and the colon can be excluded.

4 *Excision of Intestine* —Extensive adhesions around the diseased area form a contra-indication, on account of the great risk involved, to an immediate excision. If the tumor cannot be lifted out of the abdomen, the dangers of an excision are too great. If the tumor is freely movable and an excision is to be done, after lifting the tumor out of the abdomen, the mesentery of the ileum and the mesocolon are ligated close to their intestinal attachments and divided. The ileum and cæcum are clamped and the diseased intestine is then cut away. The ends of the intestine can be united in various ways, but the best results have been obtained with side-to-side anastomosis with sutures, after first closing both open ends with several layers of sutures. Mikulicz did the resection in two stages. At the first operation the tumor was brought out of the abdomen and the abdominal wound was carefully sutured. At the second operation the intestine was resected. Far better it seems to us to do a lateral anastomosis at the first operation, and then, if necessary, at a second sitting to do the resection. If we proceed

Patient reacted nicely, ran smooth course until ninth day, on which day he died suddenly with symptoms of cerebral embolism

This operation was done eight years ago To-day in a similar case I would do an ileocolostomy The exact cause of death is unknown. But even if the patient did have a smooth convalescence for nine days and then died suddenly with symptoms of cerebral embolism, the writer believes that the patient would have recovered if no intestinal resection had been done

CASE II—Louis S, age forty-five, peddler, admitted May 9, 1907 Family history negative Past history, pneumonia two months ago Present trouble began eight days ago with sudden sharp pain in right iliac fossa Pain was localized here for two days and then became general over entire abdomen, stabbing in character Bowels regular, no blood in stool, no dysuria No sweats, no chills Appetite good No vomiting, moderate fever Temperature 99.6°, pulse 100, respiration 26 Tubercle bacilli found in sputum

Physical examination, G C fair, some anæmia Lungs Signs of cavitation at right apex Abdomen Irregular tender mass, size of a hen's egg, in right iliac fossa

Operation (May 9)—Dr Wiener Abdomen opened Ileo-cæcal region thickened and imbedded in adhesions and exudate When adhesions were separated considerable pus escaped Specimen of inflammatory tissue excised for examination was reported as tuberculosis B M drain inserted, abdomen closed

July 1, small granulating sinus persists G C improved Patient discharged No subjective symptoms Weight stationary at 90 pounds

We firmly believe that many cases of this kind are put down as cases of appendicitis Had we not suspected tuberculosis and sent some of the inflammatory tissue to the laboratory, this case also would have been overlooked This case should have had an ileocolostomy done

CASE III—Nathan Z, twenty-eight, cigar-maker Admitted June 6, 1907 Family history, father died of diabetes Past history, for six months cough and bloody expectoration Present trouble, onset twelve weeks ago with diarrhœa Six to eight movements daily, stools watery and contain mucus Loss of

obstruction, and at times peritonitis and abscess formation. Such patients do not stand primary intestinal resection well. But even in desperate cases a lateral anastomosis will overcome intestinal obstruction, thereby tiding over a critical period. And even desperate cases will often improve so much that no further operation will be necessary. In some cases the intestinal obstruction *per se* is the cause of the patient's poor general condition. The tubercular ulcer may even be healed, leaving a stricture with a large inflammatory exudate around it. These are ideal cases for lateral anastomosis.

Conclusions—Ileocæcal tuberculosis is usually a primary lesion. The infection takes place either from tubercle bacilli that have been swallowed (milk or sputum) or through the mesenteric glands. Pathologically we distinguish two forms, the ulcerative or enteroperitoneal and the hypertrophic ileocæcal tumor. The diagnosis is very difficult owing to the similarity to appendicitis, with which diagnosis most cases come to operation. The two operations to be considered are lateral anastomosis with or without exclusion, and resection. In the majority of cases we suggest the lateral anastomosis first, and there will then often be no secondary operation required, or, if required, it will be done under much more favorable conditions.

CASE I.—Barnett S., twenty-five years, cap maker, admitted February 25, 1906. Family history negative. Previous history, four months ago attack of right iliac colic with vomiting, lasting three days. Right lower abdomen tender for following five weeks. Present trouble began eight days ago with right iliac colic, vomited twice. Colic lasted two days. Bowels constipated. At present patient has burning pain in right iliac region.

Physical examination, G. C. good, well nourished. Abdomen flat, symmetrical, no rigidity. In right iliac region is felt a small nodular mass, somewhat tender.

Operation (February 28)—Dr Wiener. Resection of ileocæcal junction, end-to-end anastomosis. Findings, moderately hard inflammatory mass involving wall of cæcum and ileum at ileocæcal junction, and involving mesentery of ileum. Several enlarged soft glands in mesentery.

Operation (August 1, 1908) —Dr Wiener Abdomen opened Inflammatory mass found consisting of ileocaecal junction thickened, and imbedded in adherent omentum Appendix dissected from mass and amputated Ileocolostomy done with sutures Numerous enlarged hard mesenteric nodes palpated No drainage Duration of operation 1 hour

August 8 Primary union Temperature, pulse and respiration normal

August 21 Symptoms alleviated, bowels regular, G C good Sent to Betty Loeb Home to convalesce

The patient returned in January, 1914 She had been well for five years following operation She then began to have pain in the right iliac fossa when walking fast and when turning over in bed During the past six months she had had three attacks of general abdominal pain, worse on the right side With two of the attacks there had been vomiting The general condition was fair and there had been no loss of weight The examination of the lungs was negative The abdomen was soft and not distended In the right iliac fossa there was a small, soft, freely movable, tender mass On opening the abdomen adhesions were found about the ileocolostomy opening which kinked it, and no doubt caused the attacks of subacute intestinal obstruction There was no sign of any tuberculosis, and no enlarged glands were found We made a new side-to-side ileocolostomy between the ileum proximal to the old anastomosis and the transverse colon Recovery was uneventful

CASE V —Ben L, twenty years, butler, admitted September 20, 1908 Family history negative, previous medical history negative

Present illness began eight days ago with sharp pains in right iliac fossa which have been persistent Vomited once at onset Some fever but no chills Appetite fair, no loss of weight, bowels regular, no blood in stool, no dysuria

Physical examination In the right iliac fossa, rather high up and near outer border of rectus, is a mass size of an orange, slightly movable, not tender No other masses Examination otherwise negative Temperature 99°, pulse 80, respiration 22 Urine negative

Operation (September 25, 1908) —Dr Wiener Abdomen opened, ileocaecal region found to be very much thickened and surrounded by adherent omentum and plastic exudate Ileocolos-

twelve pounds Epigastric distress and abdominal cramps for past few weeks

Physical examination, G C fair, emaciated Abdomen Retracted, scaphoid Tender, rounded mass in right iliac fossa Tenderness over entire colon Lungs Dulness and harsh breathing at right apex anteriorly and posteriorly Glands Moderate enlargement of cervicals, axillaries, and inguinals

June 9, no diarrhœa since admission Temperature 99° to 101°, pulse 92 to 108, respiration 24 to 30 Urine negative Stool and sputum negative for tubercle bacilli

June 21 Severe diarrhœa for several days Operation by Dr Wiener Abdomen opened Thickening and induration of ileocæcal region, with deposit of fine miliary tubercles on lower end of ileum Appendicostomy done

Post-operative treatment, irrigations with weak silver nitrate solution Forced diet and tonics

July 26 Patient's condition very slightly improved Leaves hospital to-day at his own request

Remarks—Appendicostomy should no longer be considered in these cases This case should have had an ileocolostomy done He was told to return for further operation but did not report again

CASE IV—Becky T, single, seventeen years, tailoress, admitted July 31, 1908 Family history negative Menstrual history negative Past history, typhoid at six years Attack of general abdominal cramps with vomiting and fever three years ago, lasting one day Since then occasional transient attacks of epigastric pain unrelated to the taking of food and unassociated with pain or vomiting

Present trouble, for three months patient has had more or less continuous dull pain in right lower abdomen, with occasional attacks of severe cramps in same locality Has been unable to work for past month Seven pounds loss of weight No sweats, no chills, no fever, no vomiting No dysuria Bowels constipated One movement every three to six days Temperature 99°, pulse 90, respiration 24

Physical examination, G C good, well nourished, some anæmia In right iliac region is felt a hard, elongated, irregular nodular mass, size of hen's egg Mass is firmly fixed, somewhat tender No rigidity No other masses, no head zone Lungs negative

February 10 Faecal fistula has closed spontaneously

March 2 Wound healed, patient discharged well

Pathological Report—Chronic inflammatory tissue, suggestive of tuberculosis

CASE VII—Solomon M, baker, aged twenty-nine, admitted August 15, 1913 Family history negative Past history negative. Present trouble, for past three weeks patient has had pains referred to right iliac fossa No vomiting, moderate fever Night sweats during past week Has lost 20 pounds during past few weeks White blood cells 10,500, polynuclears 68, lymphocytes 32 Temperature 98°, pulse 72, respiration 24 Urine negative G C good. Lungs negative Abdomen In right iliac fossa is to be felt a hard, irregular, non-tender tumor mass size of an orange Tumor is slightly movable upward and downward, but is apparently fixed to lateral pelvic wall

August 18 Abdomen opened over mass Ileocaecal region found to be thickened and surrounded by exudate, adherent to lateral pelvic peritoneum Ileocolostomy, from ileocaecal valve to six inches from caput coli Abdomen closed without drainage (Dr Wiener)

August 31 Wound completely healed

September 16 Patient on roof G C much improved, no subjective symptoms, gain of ten pounds in weight since operation One or two normal stools each day without cathartics Temperature, pulse and respiration normal

The night sweats and rapid emaciation led us to make a probable diagnosis of ileocaecal tuberculosis

CASE VIII—Mrs J S, thirty-five years old, was first seen by the writer in July, 1913 Her parents were alive and well There was no family history of tuberculosis For the past year she had complained of a feeling of weight and a dull ache in the right iliac fossa This ache had been present only at intervals, had not been severe nor had it increased in severity She had had four children, who were alive and well Six weeks before the writer saw her she had had a curettage done This had been followed by vomiting, general abdominal pain, and distention The bowels had moved with enemata These abdominal symptoms lasted four or five days Following this there were repeated similar attacks, the pain being most marked in the right iliac fossa The attacks occurred once or twice daily and increased in severity When on fluid diet, the attacks were less marked These attacks were undoubtedly due to subacute intestinal obstruction and were

tomy made in usual style One cigarette and one tube drain placed

October 25 G C good, temperature normal, moderate faecal discharge from wound

Operation (November 11) —Sinus excised, led to tiny leak in anastomosis This leak was repaired with Lembert sutures, three rows The appendix was removed and abdomen closed, small tube drain The exudate present at time of first laparotomy was found to be entirely resolved

December 12 G C excellent, wound healed Temperature normal, patient gaining weight, no subjective symptoms Discharged well

This case demonstrates very well how even a large exudate will disappear after ileocolostomy is done Seven weeks elapsed between the two operations and in that time the exudate had entirely disappeared No microscopic examination was made in this case, but it was clinically an ileocæcal tuberculosis

CASE VI —Harry J, sixteen years old, office boy, admitted January 26, 1912 Past history, mastoid operation at six years of age Best weight 96 pounds Present trouble, three weeks ago sudden onset of abdominal cramps beginning in right iliac region Had some fever, no chill, no vomiting Bowels constipated, frequent and painful micturition for past few days No blood seen in stool

Physical examination, general physical, heart and lungs, etc, negative Locally, abdomen There is general rigidity of the abdomen In the right iliac fossa may be felt a large, hard, rounded, discrete mass occupying the greater part of the lower right abdomen Only slightly tender Rectal The pelvic floor is depressed by the abdominal mass which feels hard, just as by abdominal examination Temperature 101°, pulse 104, respiration 24

Operation (January 26) —Dr Joseph Wiener McBurney incision Extraperitoneal mass encountered, on section soft yellowish-gray cellular tissue Peritoneum opened and right pelvis found to be the seat of a large hard mass apparently connected with gut A second mass was encountered and delivered, proving to be greatly thickened omentum This was resected The large mass was then bluntly opened with the finger, the appendix isolated and amputated Abdomen closed without drainage

January 28 Faecal fistula established through wound

more marked when the patient took solid food On July 15, the abdomen was opened and an inflammatory mass found around the cæcum The appendix and right ovary were removed Following this operation the attacks of abdominal pain persisted On July 29 the abdomen was again opened and a large inflammatory mass found involving two coils of ileum and the cæcum One of the coils of ileum was distended and the other collapsed A lateral anastomosis was made with sutures between these two coils of ileum, and the abdomen closed without drainage Recovery was uneventful, and there was no return of the intestinal obstruction When seen recently the patient had gained fifteen pounds, and the only thing that could be felt was a small indefinite mass in the right iliac fossa When last seen in January, 1914, the patient had gained still more in weight and nothing abnormal was felt in the abdomen

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lowing years many authors described the presence of the pneumococcus in nephritis, meningitis and endocarditis complicating pneumonia, but credit for first finding the organism in the joint fluid is usually given to Foa and Bordoni-Uffreduzzi³⁹ (1888)

The first completely reported case of arthritis in which the pneumococcus was isolated from the joint was described by Weichselbaum¹³⁷ in 1888 although undoubted cases lacking bacteriological proof had been previously reported by Fournet (1839), Grisolles⁵² (1864), Bouchard (1881), Maragliano⁸³ (1882), Bourcey¹⁶ (1883) and others. Since Weichselbaum's paper many cases have been reported and not a few notable monographs placed on record. Leroux,⁷⁵ in 1899, collected 28 cases to which Cave,²¹ in 1901, added 3, Cole,²⁶ in 1902, added 9, Herrick,⁵⁶ in 1902, added 21 etc, etc. Other notable contributions have been made to the subject by Pfisterer,¹⁰⁴ Herzog,⁵⁷ Gasne,⁴⁶ Zesas,¹⁴⁴ and other writers.

ETIOLOGY

Incidence — That the condition is a rare one is shown by the comparatively few cases on record. We have been able to collect only 172 cases although the condition was first described 25 years ago. Its frequency in relation to pneumonia is generally given as about one in eight hundred, Table I showing one arthritis in each 727 of a total of 12,364 cases of pneumonia collected. Raw¹¹¹ found the remarkably high figure of 1 per cent. in his London cases, but the majority were alcoholics, a condition predisposing to arthritis.

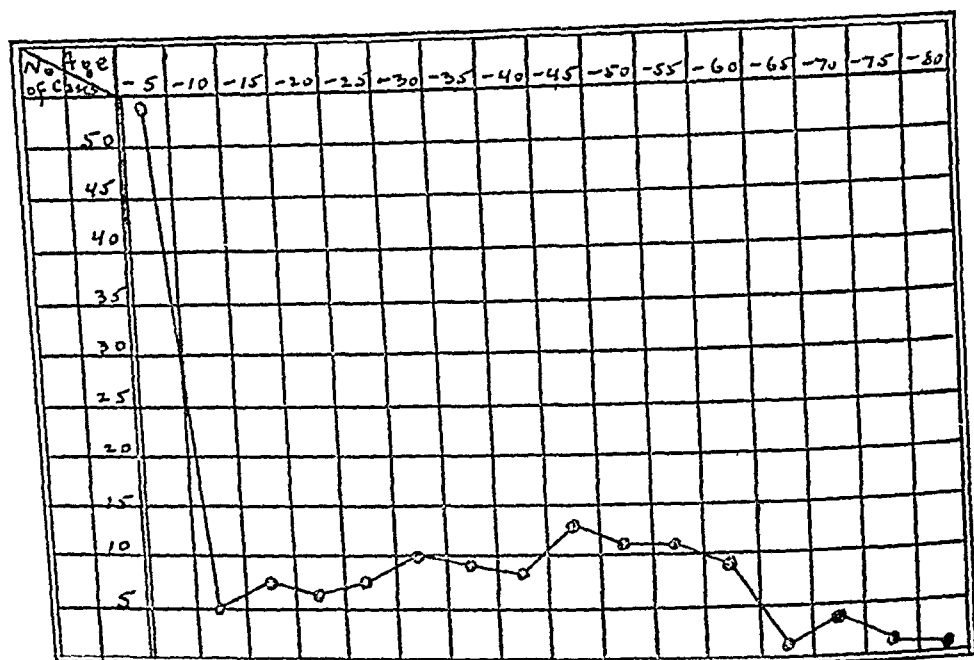
tis Dudgeon and Branson³⁰ have shown that while suppurative arthritis is uncommon during the first 6 months of life, the causative agent is in the majority of cases the pneumococcus. Herzog⁵⁷ explains the frequency of infective arthritis in infants by the peculiar structure and vascular arrangement of the bony rudiments of the joint. He quotes Neumann who has shown that the capillaries of the bone marrow in infants are of larger calibre than the smallest arteries, an arrangement whereby the blood current is rendered extremely slow and the deposition of infective organisms in the tissues is favored. The number of cases occurring between the ages of 25 and 60, the period of greatest activity, is probably explained by trauma, etc., a point which we will later discuss in detail.

Sex—There were 102, or 65 per cent males, and 53, or 35 per cent females, in our series. In 18 cases the sex was not mentioned. Earlier writers have all given a still higher proportion of males. This disproportion has usually been ascribed to the influence of trauma which unquestionably, predisposes to infection and to which the male is more subject than the female. In order to determine this point we have analyzed the sexes above the age of 10 years, assuming that below that age trauma plays an indifferent or at least an impartial rôle. We found approximately 78 per cent males and 22 per cent females, quite a contrast with our original figures of 65 per cent and 35 per cent, respectively.¹

Predisposing Factors—Besides the acknowledged fact of the lack of resistance of synovial membranes to infection, there is strong evidence that partial immunity of the host or decreased virulence of the organism play their part in the joint localization. Bezancon and Griffon,¹¹ working with the pneumococcus, were unable experimentally to produce alone an arthritis in rabbits without first partially immunizing them by repeated inoculation of non-virulent cultures. They concluded that pneumococcus arthritis was more apt to appear with a culture attenuated by age or by an enormous dose into an animal rendered relatively immune by previous vaccination. Lippmann⁷³ believes that a pneumococcus of feeble power having

Age—The condition was first described as one of late adult life Gasne,⁴⁶ however, in 1908, was able to collect 52 cases in children under 2 years of age, and in our series 53 cases or 34 per cent have occurred during the first hemidecade. It is unfortunate that Gasne did not publish the details of his cases, as many of them we have been unable to trace. Fig 2 represents graphically the age incidence. The youngest case in the series was 11 days old and the oldest 79 years.

FIG 2



Showing the number of cases occurring in each hemidecade

A close survey of the chart shows a large number of cases under the age of five years, a sudden fall, then a gradual increase up to the twenty-fifth year. A rather uniform number occurs during each five year period from then until the sixtieth year, when the number of cases rapidly decreases. We can thus accurately state that the disease is more common during infancy than in any other period of life, a statement which, in 1910, Howard⁴³ thought we were not warranted in making. Herzog⁴⁷ believes that children are particularly susceptible to pneumococcus infections of all sorts, and particularly to arthri-

high enough to definitely indicate the rôle played by trauma, previous joint disease, and chronic systemic infection and poisoning. The conditions mentioned were as follows:

Rickets . . . . .	.. ..	4
Previous tuberculosis of joint . . . . .	.. . .	1
Injury . . . . .	. . . .	6
Alcohol and injury . . . . .	. . . .	2
Rheumatism . . . . .	.. . .	11
Injury and rheumatism . . . . .	.. . .	2
Plumbism . . . . .	. . . .	2
Gout and plumbism . . . . .	. . . .	2
Previous typhoid arthritis . . . . .	.. . .	1
Syphilis . . . . .	.. . .	4
Alcoholism . . . . .	. . . .	9
Marasmus . . . . .	. . . .	1
Gout . . . . .	.. . .	1

Relation to Pneumonia—The cases may be classified according as to whether they have occurred during or after a pneumonia (meta- or postpneumonic), before a pneumonia (prepneumonic), or independently of any inflammatory lung lesion. Our cases may be divided as follows:

Following a pneumonia	73
Preceding a pneumonia	5
Pneumonia associated with arthritis but relation not stated	38
No pneumonia	48
Presence or absence of pneumonia not stated	9
	<hr/>
	173

It is thus seen that 70 per cent of the cases are associated with a pneumonia, and that 93 per cent of these follow and 7 per cent precede the lung lesion.

The meta- and postpneumonic cases are thus in the vast majority, Bourcey¹⁰ considering that most of them occur during the stage of red hepatization. The duration of time between the onset of the pneumonia and that of the arthritis varies from one day to 20 years (Schuster^{11a}), and averages (excluding the long cases of Schuster,^{11a} 20 years, and Popescu,¹⁰⁷ 4 months) about 11 days, arthritis being more liable to follow a pneumonia in adults than in children.

broken into the circulation is unable to produce a generalized infection, is repelled by the stronger tissues, and finally gets a foothold on a serous articular surface. This theory is supported clinically by our statistics. In 73 cases of our series in which the arthritis followed a pneumonia eleven days was the average time elapsing between the onset of the pneumonia and that of the arthritis. This is exclusive of two cases (Popescu¹⁰⁷ and Schuster¹¹⁰) in which the arthritis followed the pneumonia four months and 20 years respectively. This long period before the onset of the arthritis argues strongly in favor of the development of a partial immunity, or of an organism of decreased virulence, or both.

Trauma and previous joint disease unquestionably play their part also, as is shown by both experimental and clinical evidence. As to experimental evidence we can do no better than quote the summary made by Cole,²⁶ of work in this line. It is as follows: 1. Injection of virulent cultures of the pneumococcus into the joint of a susceptible animal is almost always followed by acute suppurative arthritis. 2. Subcutaneous injections after previous excitation of an aseptic inflammation of a joint give results some positive and others negative. 3. Intravenous injections (with conditions as in 2) are more apt to give a positive result. The first condition we have not encountered in the literature, no cases of punctured wounds of joints followed by pneumococcus arthritis having been found. Neither have we encountered the second condition in which a subcutaneous infection by the pneumococcus has given rise to a pneumococcus arthritis, although a number of cases of cutaneous and subcutaneous infection (Judd,⁶⁵ Powers¹⁰⁸) have been reported. The third condition is reproduced almost identically in man, for Rosenow¹¹⁵ was able to demonstrate the pneumococcus in the circulating blood in 91 per cent of 175 cases of pneumonia. And this is where trauma and previous joint disease play their part. In 24 per cent of our cases we have found cause for a *locus minoris resistentiæ*. This figure is lower than those given by Leroux,⁷⁵ Cave,²¹ Cole,²⁶ Pfisterer,¹⁰¹ and Herrick,⁵⁶ but, nevertheless, we consider it

In the remaining 26 cases we believe that the primary focus or point of entrance of the organism was not found, but was nevertheless present. These cases have often been classed as primary and possibly correctly so. Allen and Lull³ reported their case in 1901 as the first primary case on record, while a year later Cole²⁶ classified 9 cases as primary. The question is largely an academic one hinging on whether the pneumococcus can traverse a mucous membrane without causing a lesion of the same, or whether this lesion if present shall be called the primary focus and be disregarded. For our part we prefer to consider all the cases as secondary, arguing that the joint can only be infected through the blood or lymphatic streams and that the organism in order to reach either of these systems must traverse the epithelial covering of the body, either skin or mucous membrane, and in so doing cause a lesion, no matter how small, which actually is the primary focus.

PATHOGENESIS

In the meta- or postpneumonic cases the portal of entry is unquestionably the respiratory tract. In the prepneumonic cases and in those not associated with a pneumonia the point of entry is varied. In many cases it cannot or is not found, 29 of our 47 cases. Probably in the majority of these cases, as pointed out by Herzog,⁵⁷ the portal of entry is the middle ear. Especially is this true in children. Zeufel (quoted by Howard) found 40 per cent of the cases of otitis media in children to be due to the pneumococcus. Reference to page 78 shows the portals of entry which we have encountered. Three reports are particularly worthy of mention. In Nattan-Larrier's⁹¹ case a pneumococcus arthritis of the shoulder followed the infection of an operative harelip wound, the organism being recovered from the pus in the joint and from the wound. In Low's⁸⁰ case a multiple arthritis from which the pneumococcus was recovered was secondary to a primary hemorrhagic ulcerative pneumococcus cystitis. In Cohen's²⁵ case the arthritis

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The cases not associated with any pulmonary involvement are of more interest and comprise the surprisingly large figure of 29 per cent of our series, this condition having been found 48 times. Of these, 27 cases, or 59 per cent, occurred in children under ten years of age and 19, or 41 per cent, in older individuals. In the first group a primary localization of the pneumococcus is mentioned in 55 per cent of the cases, while among the older individuals it is noted in but 36 per cent. Of the 48 cases not associated with pneumonia only 18 are noted as having some focus of pneumococcus infection previous to that of the joints. It will be noticed that most of the cases (15 out of 22) in which the primary focus was discovered were in children. These are as follows:

Infection of harelip wound (infant)	1
Conjunctivitis (infant)	1
Measles (infant)	1
Varicella (infant)	1
Bronchitis (infant)	2
Influenza (adult)	1
Cystitis (adult)	1
Pyosalpinx with umbilical fistula (adult)	1
Enterocolitis (infant)	2
Tonsils and pharynx (adult 1, and infant 2)	3
Suppuration at umbilicus (infant)	1
Abscess of thigh (infant)	1
Otitis media (infant 3, adult 2)	5
Labor and peritonitis (adult)	1

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mation may lie in a comparative examination of the anatomy, physiology, and pathology and, especially, of the habits of those races of man and those lower animals in whom cancer of the stomach is rare

Among the precancerous lesions of the stomach, ulcer is the most common. Yet it is a curious fact that ulcer of the duodenum is three times as frequent as of the stomach, though cancer of the duodenum is rare. True it is, however, that ulcer or some other lesion in the stomach, which is of sufficient gravity to produce symptoms not necessarily of ulcer, but symptoms of chronic irritation, existed in more than half of all those cases of cancer of the stomach in which we have been able to make a resection and in a high percentage of these an ulcer was found pathologically^{23, 24} (Figs. 2 and 3). Some pathologists believe that these ulcers are carcinomatous from the beginning. If so, then the base of the ulcer should be carcinomatous (Fig. 4), but in our cases there was no cancer in the base of the ulcer, it was the overhanging margin of the ulcer which showed the cancer (Figs. 5 and 6). It is evident that precancerous lesions exist in the stomach and that these lesions, while possibly not always ulcer, give clinical evidence of their presence in the precancerous stage in at least fifty per cent. of the cases in which the history is taken with this point in view. The extraordinary muscular activity of the stomach in the condition known as pylorospasm, which may result from gall-stones, duodenal ulcer, fecal stones in the appendix, or intestinal lesions, may account for the chronic gastric irritation in some cases. It is even possible that through the influence of this great muscular contraction cells may be loosened and even forced into the underlying tissue.

The prophylaxis of cancer of the stomach consists not only in the removal of gastric ulcers, but also in the relief of all those conditions which cause gastric irritation resulting in the symptom inadequately and possibly incorrectly described as pylorospasm.

Cancer of the small intestine is extremely rare. In a series of 1882 cancers of the gastro-intestinal canal operated on in our clinic (October 1, 1897 to November 1, 1913) only 22

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are not concerned in this paper. Suffice it to say that the animals remained in good condition with high blood-pressure in one case—the only dog watched till death—for twelve hours, and that they rather suddenly passed into a moribund condition.

CONCLUSIONS.

Our conclusions, which we hope to support by more numerous experiments, and by reporting them in greater detail in the future than has been possible in this paper, are as follows:

1. As severe a degree of shock may be produced by artificial hyperrespiration, and by handling of the intestines when provision is made for keeping the carbon dioxide content of the blood high, as when it is allowed to fall to 40 or 50 per cent. of the normal.

2. Shock produced by artificial hyperrespiration is due chiefly to a long-continued, mechanical interference with the return of the blood to the heart.

3. There is evidence that the early stages of shock produced by evisceration and handling of the intestines is due to inhibitory afferent impulses.

4. At the end of the period during which the intestines were handled none of the animals' nerve centres were exhausted.

5. By such handling of the intestines a complete splanchnic paralysis of local peripheral origin is produced, and it is this paralysis which causes the subsequent fatal fall of blood-pressure and not exhaustion of the nerve centres.

6. In the presence of a good blood-pressure and unimpaired vasomotor compensatory mechanism, prolonged afferent electrical stimulation for two hours will not produce shock or exhaustion of the nerve centres.

7. If trauma to the sensory nerves is a factor in production of shock in an unconscious animal, it is wholly subsidiary to other factors, and it is questionable whether it was apparent in our experiments even when these other factors had rendered the nerve centres more vulnerable by toxic influences, as ether, or by a fall in blood-pressure.

were cancers of the small intestine Why is there this relative immunity of the small intestine over the stomach and the large intestine? The small intestines are the most primitive part of that system on which the maintenance of the body-functions depend Is it possible that in the long heredity of this particular part it has developed an immunity? There is something fascinating about this theory as accounting for the lack of immunity in the stomach and the large intestine, which have relatively a short heredity The small intestine is exceedingly primitive That the age of any part of the body has much to do with its ability to resist disease is well known Though it may be a figure of speech that woman was formed from the rib of man, yet it is certainly true that the ovary is descended from the testicle and that the testicle is the primitive organ found in bisexual species²⁵ Tumors of the testicle are rare As shown by Ewing,²⁶ all the new growths of the testicle with few exceptions are teratomas, the most primitive type of neoplasm The ovary, on account of its short heredity, is subjected to a multitude of diseases and a large variety of tumors

Beard's²⁷ theory that the immunity of the small intestine is due to the pancreatic secretion destroying whatever malignant virus may exist therein may also be mentioned It is interesting to note, however, that the small intestines have comparatively few sources of chronic irritation and that when malignant disease of the small intestine is found it is usually due to a pre-existing lesion, such as a degenerating polyp, adenoma, or papilloma (Fig 7)

Cancer of the appendix usually occurs in association with chronic obliterative processes²⁸ (Fig 8)

The large intestine has a much greater liability to malignant disease than the small intestine and the frequency with which cancer is found to be grafted on a source of chronic irritation can only lead to the conclusion that the soil produced by chronic irritation needs only to be activated by the cancerous virus to produce cancer in susceptible individuals The rule is that the original lesion, by the time operation is made, has been completely obscured by the carcinomatous process,

SYSTEMIC BLASTOMYCOSIS.*

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OF DENVER, COLO.,

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THE knowledge of the fact that yeasts may act as pathogenic agents dates from the year 1890 when Grohe¹ reported to the Greifswald Medical Society the result of experiments made by him with mould and yeast fungi injected into the blood or peritoneum of animals. These animals usually died shortly after injection. In 1892 Popoff² employed ordinary commercial compressed yeast which was cut into small pieces, dried, ground to a powder, strained through a towel and injected into the blood-vessels, beneath the skin, and into the thoracic cavity of dogs. The animals usually died within a few hours or days, with septic phenomena. Popoff often noted the appearance of nodules, resembling tubercles, in the kidneys, spleen and lungs. Microscopically these nodules were found to contain yeast cells and starch granules. The above named experiments were made with impure material and were therefore hardly considered convincing.

The first article carrying full conviction regarding the problem of pathogenic yeast was published by Baum³ who injected several kinds of yeasts into rabbits, apparently observing localization and growth of these microorganisms in the animal body.

or life condition which causes chronic irritation, that where cancer in the human is frequent a close study of the habits of civilized man as contrasted with primitive races and lower animals, where similar lesions are conspicuously rare, may be of value, and finally, that the prophylaxis of cancer depends, first, on a change in those cancer-producing habits and, second, on the early removal of all precancerous lesions and sources of chronic irritation

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but in all our early operations lesions of a precancerous nature were found. Especially is this true of the sigmoid and rectum, where, in 37 cases of diverticulitis, the irritation of the little hard balls of fecal material in the ends of these pouches has given rise to malignant disease in twenty per cent of the total^{29,30,31,32} (Figs 9, 10, 11 and 12). It is probable that the supposed long duration of cancer of the large intestine, cases of which have been reported, were in reality tumefactions from chronic diverticulitis followed later by malignant change.

We must not lose sight of the fact that a changing physiology of an organ may be of itself a source of weakness and possibly act as a cause of local irritation. Such a change is undoubtedly going on in the proximal half of the large intestine. Plant life is parasitic on the inorganic world and depends on chlorophyl for its potency. We should know more about chlorophyl upon which in the last analysis life depends. Animal life is parasitic upon plant life, man on both plant and animal and increasing rapidly the flesh intake. Within the last 100 years, four times as much meat is taken as before that time³³. If flesh foods are not fully broken up, decomposition results and active poisons are thrown into an organ not intended for their reception and which has not had time to adapt itself to the new function.

The development of malignant disease in the uterus and kidney shows the same relation to chronic irritation. Cancer of the cervix occurs fifteen times as frequently as cancer of the body of the uterus, but in myomatous disease cancer of the body of the uterus is found five times as frequently as cancer of the cervix, the chronic irritation of the uterine tumors increasing the incidence 75 times (Fig 13).

Of all the cases of epithelial cancer of the kidney which came to operation in our clinic not less than 50 per cent were demonstrably superimposed on extensive renal calculus formation (Figs 14 and 15).

In conclusion, I would again call attention to the fact that pre-existing lesions play the most important part of the known factors which surround the development of cancer, that such precancerous lesions are produced by some habit

which came under their observation in the surgical clinic at Greifswald. Shortly thereafter, and independently, Gilchrist⁹ reported a case of skin disease, supposed to be due to yeasts, in man. However, in view of the fact that he made no cultures, his observation is hardly to be regarded as convincing. Busse would accordingly seem to be entitled to the credit of having been the first to make clear observations.

In a general way it may be said that the disease in animals, appearing in epidemics, is relatively benign in character. Many animals get well, while the majority of the fatal cases seem to succumb to exhaustion through the superficial distribution of the process rather than through its penetrating to the viscera. Buschke considers the avenue of entrance as ordinarily occurring through the skin, whence, in man, it is carried into the interior of the body. As far as he is able to ascertain, the distribution takes place by way of the lymph-channels through which the fungi reach the lymph-glands. In the rarer cases of retrogression of the local disease a subsidence of the pathological process can also be noted in the lymph-glands. For further and extensive account of the pathological process the reader is referred to this valuable and instructive article by Buschke.

In systemic blastomycosis, as well as in the cutaneous form, the most common change is represented by a simple mycosis. Proliferation processes may develop in the affected tissue much as they do in the so-called infectious granulomata.

An instructive communication was made in 1910 by Franchetti and Cazzaniga,¹⁸ who believed themselves justified, on the basis of cases described in literature, of personal experimentation and the experiments of others, in coming to the conclusion that yeast microorganisms undoubtedly possess pathogenic properties, although this particular family of fungi is very large and the group is still obscure.

As regards the clinical course of infectious blastomycosis, experimental findings serve to confirm the results of clinical observations. The course is usually slow, anæmia is present, there is generally progressive emaciation. Albuminuria is

frequent and the end is almost always fatal in the severe general infections and in the forms with localization in the nervous system. Any or practically all of the tissues of the body may be affected.

Two cases of systemic blastomycosis, both fatal, have come under my observation. The first was a man of forty-four years who gave the following history. He suffered from pneumonia at 19 years of age, while at the age of 23 years he had a bronchial cough which lasted for one year. Two years later this cough returned and continued for one year when he went to the Adirondacks, living there for about six months. He had had no subsequent chest trouble. At 32 years of age he noticed two small, soft lumps in the lower part of the neck, one above each collar-bone. These gradually enlarged and were removed 15 months later. No microscopical examination seems to have been made, the sinuses healed slowly.

In 1902 two small, hard nodules, each about the size of a pea, appeared in the lower part of the neck in the median line and were removed. One year later another nodule was removed. At this time the general health was considerably below par.

In the latter part of 1903 he went to South Carolina where the general condition tended to improve. At about this time another lump appeared but it gradually subsided. This lump re-appeared six months later and was taken out. In 1906, while in Europe, he suffered attacks of indigestion and jaundice, these attacks lasting two or three months. From this time, 1906, until the autumn of 1910, his general condition remained fairly good. He spent the winter of 1910-11 in California and during these winter months many lumps appeared below the lower jaw on each side. He passed the spring of 1911 in Arizona, coming to Denver in June, at which time I found the entire neck below the lower jaw, on each side, filled with hardish lumps and presenting multiple sinuses. The general condition was much impaired. I cleared the neck thoroughly on each side, but through some unfortunate error, possibly owing to the fact that I was leaving town, the tissues were not histologically examined. My own clinical diagnosis was tuberculosis. Two or three weeks after this operation upon the neck small, soft lumps appeared on the

abdomen and thighs beneath the skin. These were opened, discharging pus and healing rather slowly

In August, 1911, evidence of disease of the two last dorsal vertebrae was found, both on examination and by the X-ray

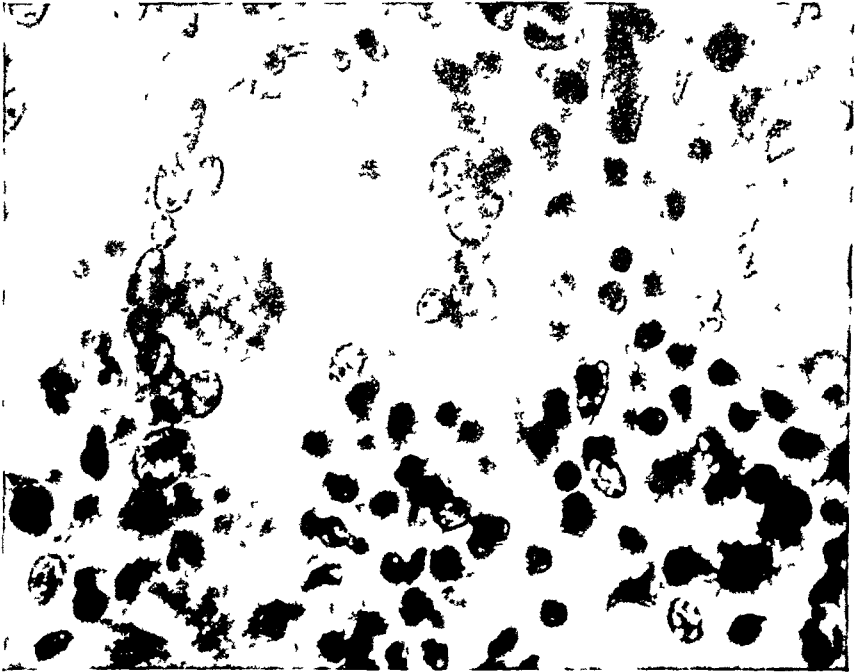
In October, 1911, on my return from Europe, I opened a number of moderate sized abscesses on the back, thighs, and right hand. Cultures from these abscesses gave pure blastomycosis. From time to time other abscesses appeared in different parts of the body and on being opened showed, on culture, the same micro-organism. Thoracic and abdominal symptoms came on and from August, 1911, the patient's health gradually failed. Management rested on general tonics, the best possible attention to the general health, and on the occasional employment of potassium iodide and cupric sulphate. These latter drugs were not well borne and he died from exhaustion April 20, 1912. Autopsy was made by Dr. Ross C. Whitman, Professor of Pathology in the University of Colorado. Dr. Whitman's report is as follows

Pathological Diagnosis—Sinuses angle of left jaw, right side of neck above clavicle, extensor surface right thumb and on back. Six openings at various levels either side of spinal column, and one on inner aspect left thigh. Emaciation. Multiple military abscesses of liver, 2 military abscesses spleen, caries thoracic spine, iliopsoas abscess (moderate size, not prominent), military abscess pelvis left kidney, nephritis(?), acute, fibrinous, left-sided pleurisy with exudate. Destruction lower lobe left lung.

Dr. Whitman further reports: "The lesions found macroscopically in bone, liver, pleura and submaxillary lymph-nodes, as well as the microscopic lesions found in the spleen, are everywhere essentially alike, the differences being apparently due in part to the stage of development of the individual lesion, and in part to the physical conditions, as in the pleura, where the character of the serous membrane and friction have somewhat modified the picture. The main features of the disease process can be reconstructed in considerable detail.

"The organism lodges first in a small vessel or capillary. The endothelial cells proliferate, becoming larger and plumper, and separate from the wall. Later they may fuse about the organism to form a typical giant-cell of the Langhans type. The vessel is occluded, and the vessel wall disappears, leaving a collection of endothelial cells. This enlarges, encroaching on the surrounding parenchyma, which disappears, leaving a supporting connective tissue stroma and capsule. The connective tissue also increases to some extent, and may organize the lesion, replacing it by scar tissue. In the earlier stages of the lesion there is more or less

FIG 1



Intravascular formation of giant-cell about a blastomycetes
immersion, comp oc No 8

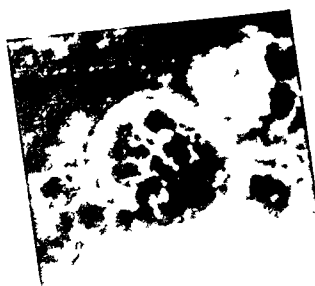
Zeiss apo obj, 2 mm ol

FIG 2



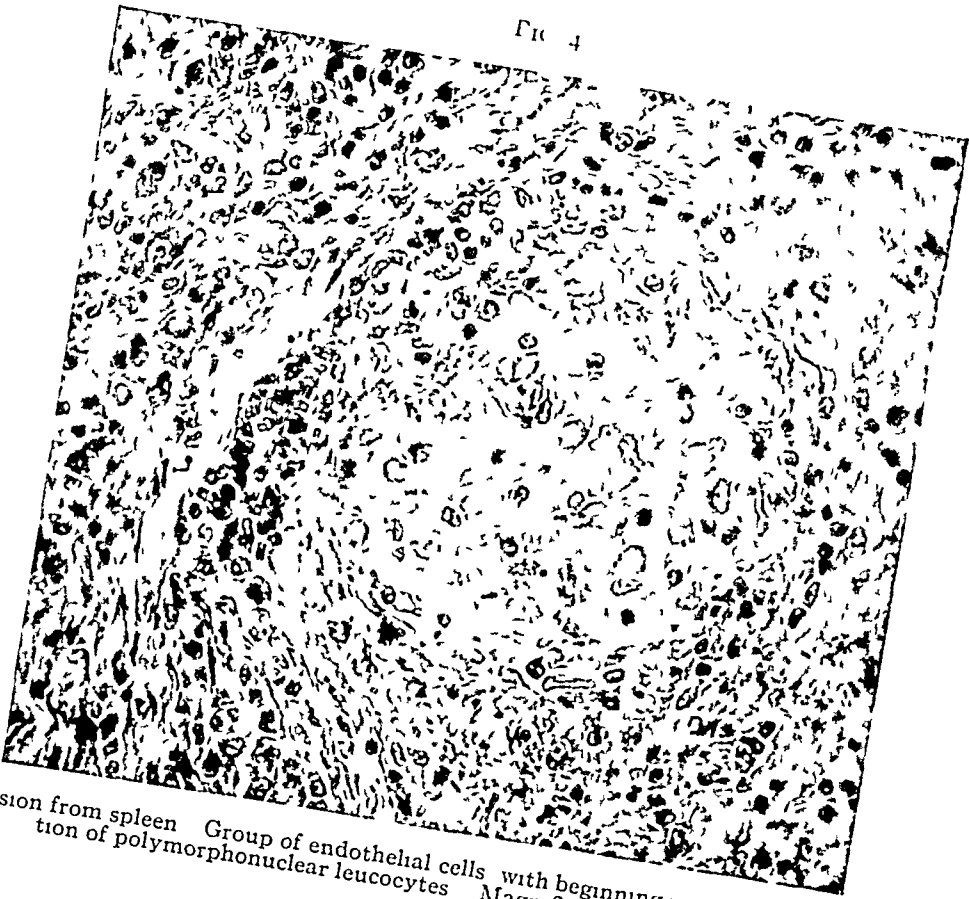
Small granuloma from pleura consisting of a collection of endothelial leukocytes (endothelioid cells). The wall in this cyst consists of fibrin. Zeiss apo obj 16 mm without ocular

FIG 3



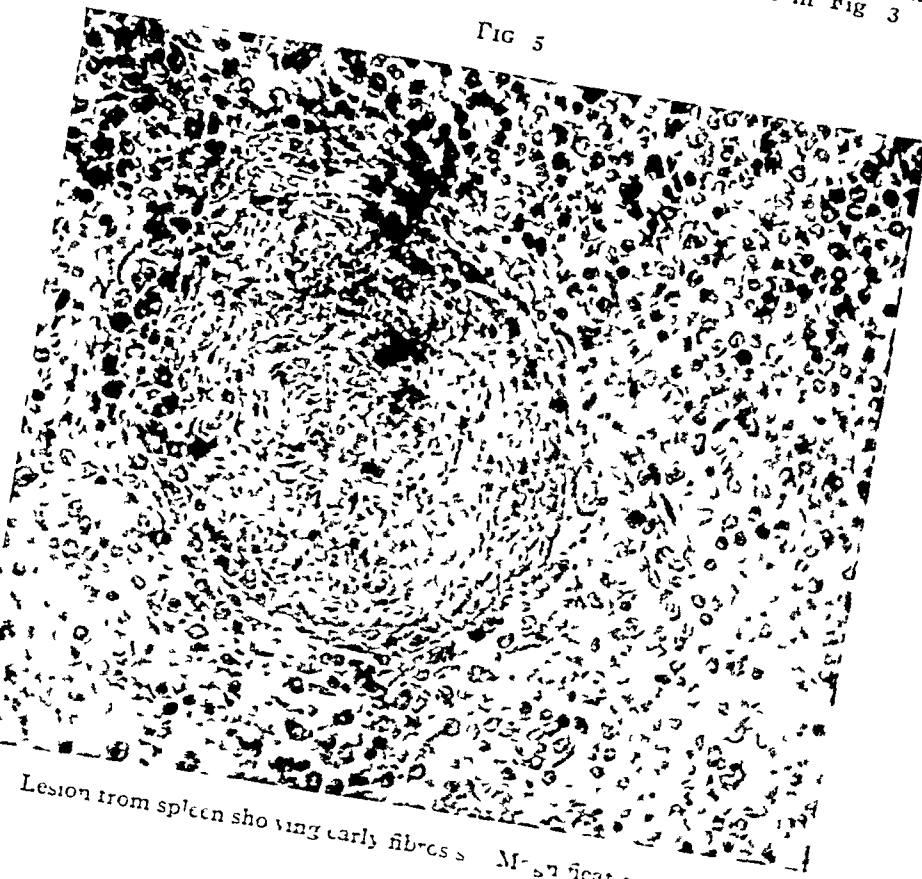
Blastomyces showing endospore formation (ascus formation). Zeiss apo obj 2 mm comp oc No 4

FIG 4



Small lesion from spleen Group of endothelial cells with beginning necrobiosis and infiltration of polymorphonuclear leucocytes Magnification as in Fig 3

FIG 5



Lesion from spleen showing early fibrosis Magnification as above

infiltration by leucocytes among which plasma cells and eosinophilic myelocytes are a striking feature, which serves at once to distinguish the process from tuberculosis. Somewhat later the cells of the lesion undergo a wide-spread and uniform coagulation necrosis, similar to the type commonly met with in rapidly growing malignant tumors, and differing from caseation in the fact that the structure of the cells can be recognized for some time after necrosis has taken place. Lesions as large as 1-2 cm in diameter may consist of a capsule surrounded by a narrow zone of leucocytes and small daughter lesions, and containing a pasty mass of necrotic cells with little or no living tissue. Ultimately, the dead tissue is extensively infiltrated by polymorphonuclear neutrophils, the disintegration of which, with the resulting liberation of proteolytic ferments, is doubtless responsible for the liquefaction which occurs.

"The process in the pleura is modified by the pouring out of a profuse fibrinous exudate in which abundant pus cells are found. Apparently there has been no tendency to walling off, the exudate having spread uniformly over the entire serous membrane.

"The organism is found fairly abundantly in all the lesions. It was described in some detail by myself in a paper published last summer (*Journal Infectious Diseases*, vol xiii, p 85, 1914). It will suffice here to call attention to the fact that unquestionable budding forms are not found. Multiplication seems to take place only by 'endosporulation,' which in the paper above mentioned is interpreted as ascus formation. I can but think that the original condition in this case was blastomycosis."

My second case was observed some years ago and in its main features followed the course of the one just narrated, excepting that the original focus was a nodule at the back of the left hand, which nodule had undergone suppuration and curetting some three years before the patient came under my observation. The case terminated fatally with thoracic, abdominal and joint lesions. The histology and bacteriology were carefully studied and reported upon by Dr J A Wilder, at that time Professor of Pathology in the University of Denver.

The literature upon this subject is abundant and need not be reproduced here. The central thought in my mind is that the systemic form of blastomycosis is almost invariably fatal and that this grave condition generally begins in a small local focus. I believe that such local focus or foci should be very widely excised as early as possible, in order to attempt to forestall dissemination.

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THE VALUE OF GLUZINSKI'S TEST IN THE DIAGNOSIS OF GASTRIC ULCER.*

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THE chemical analysis of the stomach contents after test-meals is of relative value but not pathognomonic¹ Many surgeons of large experience are even of the opinion that the chemical analysis takes only a very subsidiary place in the diagnosis of diseases of the stomach

It therefore created considerable attention, when Kocher at the German surgical congress, 1912, recommended Gluzinski's reaction as a means of making the differential diagnosis between ulcer and cancer, thus bringing to the fore a half forgotten method described for the first time some ten years ago

Gluzinski² proceeds from the supposition, which is now going to be accepted as a fact, that a great number of cases of cancer of the stomach develop upon the basis of an ulcer

His working hypothesis is as follows

An *ulcer* situated in the pyloric portion being the cause of retention is, as a rule, accompanied by *hyperacidity* of the contents, while a *cancer* is attended by a mucous (or atrophic) catarrh which causes a *disappearance of the free hydrochloric acid*.

During the transformation of an ulcer into a cancer there will yet be found free hydrochloric acid up to a certain stage of the disease But during the progress of the mucous catarrh there will occur a *secretory insufficiency* which may be

* Read before the American Surgical Association, April, 1914

¹ W J Mayo Operative Treatment of Cancer of the Stomach
Journal of the Amer Med Assoc, Bd 61, No 8

² Gluzinski Ein Beitrag zur Fruhdiagnose des Magenkrebses Mitt
aus d Grenzgeb d Med u Chir, Bd x, 1902, p 1

demonstrated by giving two test-meals, one meal following immediately upon the other

Gluzinski examines the gastric contents (1) recovered from the fasting patient, (2) after administering a test breakfast consisting of the white of a boiled egg and 200 c.c. of water which is recovered after three-quarters of an hour, (3) after a test dinner consisting of a beefsteak and 250 c.c. of water which is recovered after three and three-quarters hours

The stomach is washed out before and after the first meal and the second meal is given immediately after the second washing

In *ulcer* both the breakfast as well as the dinner give distinct reaction of free HCl

In beginning cancer the *first meal* also will give distinct reaction of free HCl, while the *second one* will show only a slight trace, or free HCl will be altogether absent

He diagnosed a beginning cancer in 3 cases, the diagnosis being verified at subsequent operation

This method is being utilized by Kocher who has somewhat modified it and enlarged upon its applicability

By determining the percentage of free HCl in the two meals he has found that the free acid is present in larger quantities after the second meal in *ulcer*, while in *cancer* this meal (the test dinner) shows the lowest percentage of hydrochloric acid³

The preeminence of this method is that the diagnosis of ulcer or cancer is *not* based on the *absolute* value of free HCl in the gastric contents, but on the *increase* or *decrease* in the amount of free acid in the recovered meals

But, moreover, he believes that the method may be used also in the *absence* of free hydrochloric acid in which case the *total acidity* shows the same proportions, always supposing that there is no lactic acid present

In 30 cases of ulcer tested according to this modified

³ The cases tested in this way at the Clinic Berne are described by Fomio Ueber die Resultate der Untersuchungsmethode nach Gluzinski u s w Deutsche Zeitschr f Chir, Bd 116

Gluzinski method, the diagnosis was verified at operation in 27 cases, in 2 cases the result was uncertain and in 1 case there was found carcinomatous degeneration of an ulcer, although the test indicated the presence of a simple ulcer (Borghis or Petit)

The results obtained by Kocher are to some extent being contested by Dr Rusca,⁴ Berne, while Kleinschmidt⁵ and Hohlbaum,⁶ both of Leipzig, speak very approvingly of the value of the test

Before describing our own experiences I must state that both Gluzinski himself as well as Kocher and those who later have adopted the method most emphatically take reservations against the belief that they are accepting the results of this chemical reaction as decisive for the diagnosis. It is nothing but a symptom which is to be judged in conjunction with the other symptoms and with the history of the case

As to *the theoretic foundation* for the method this seems to be pretty well laid

My first assistant, Dr Backer-Grondahl,⁷ has made some examinations upon an otherwise healthy person with a gastric fistula established because of a cicatricial stricture of the oesophagus

Grondahl administered Gluzinski's test-meals through the fistula and the results of his examinations are in accordance with those already known from the experiments of Pavlow upon animals and from the experiments by Hornberg upon the case of a patient with gastric fistula

There occurs reflexly an increased production of gastric juice when the gastric mucous membrane receives an increased food irritation

⁴F Rusca Beitrag zur Magendiagnostic, etc Correspondenz-Blatt f Schweizer Aerzte, 1913, No 46, p 1498

⁵Kleinschmidt Überblick über das Magenmaterial der Leipziger chir Universität klinik

⁶Hohlbaum Ergebnisse der Salomonschen und der Gluzinskischen Probe, etc Centralblatt f chir, 1913, No 35

⁷N Backer-Grondahl Forelobige resultater med Gluzinski's undersøkelsesmethode, etc Nordisk Tidsskr i Terapi, xi, Aarg 11 H, 1913

It has been shown that not only is the amount of gastric juice increased but also is the concentration of the hydrochloric acid greater as the irritation increases

At the surgical clinic of Christiania University we have employed the Gluzinski method since October, 1912, in the examination of 86 cases, to wit 25 cases of gastric ulcer, 9 cases of duodenal ulcer, 21 cases of cancer of the stomach, 15 cases of gastro-enteroptosis, 11 cases of chronic appendicitis and 5 cases of gall-stones

The diagnosis is in all of the cases controlled by operation, some of the ptosis cases only by rontgenogram

Of our *cancer* cases two only had free hydrochloric acid and in both the test agreed with the results as obtained by Gluzinski, to wit a *decreasing* amount of free hydrochloric acid in the test dinner (Fig 1)

In those cases of cancer of the stomach where free hydrochloric acid was absent we have found *no regular decrease of the total acidity*, we are so far unable to support the statement made by Fonio, that the method may be used in such cases

In fact, the total acidity was *increasing* in the second test-meal in about 50 per cent of the cases

During our further examinations we soon arrived at the conclusion, however, that the percentage of free HCl may *decrease* in the second meal *also in diseased conditions of the gastro-intestinal canal other than cancer of the stomach*

We found the free hydrochloric acid values to be diminishing in the test dinner in cases of *gastro-enteroptosis*

But not in all of them—the phenomenon was not dependent upon the anatomical position of the gastro-intestinal canal in itself—we found it in cases where chronic obstruction appeared simultaneously with gastro-enteroptosis (Fig 2) Cases of gastro-enteroptosis without obstruction are shown on Fig 3

In the first of those cases we made resection of the pylorus because we imagined that we felt a hard little knot in the wall of the stomach But microscopical examination of the

FIG 1

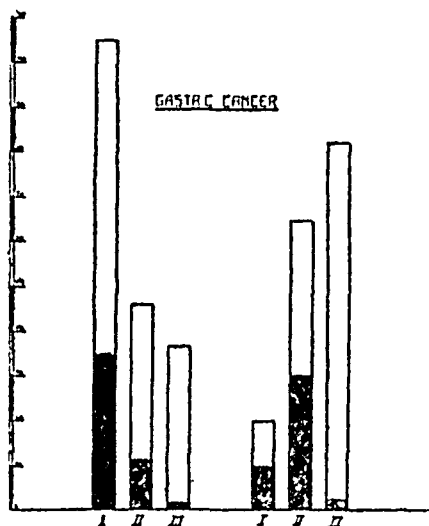


FIG 2

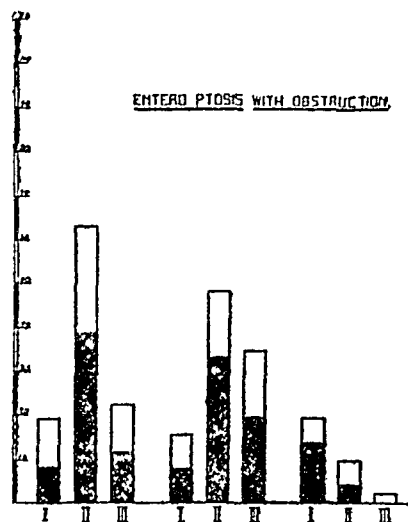


FIG 3

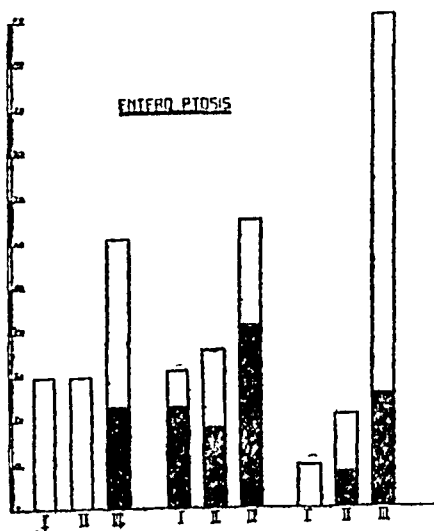


FIG 4

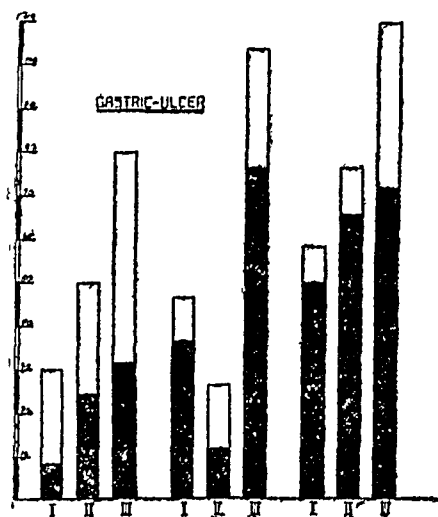
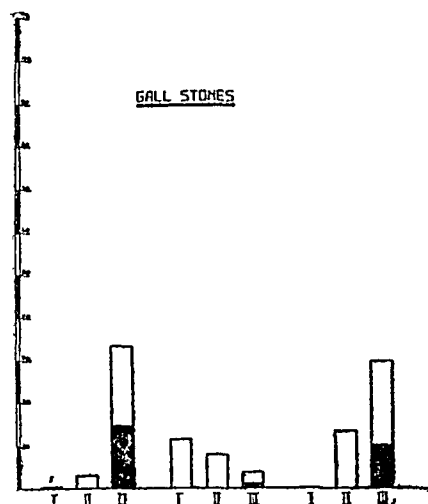


FIG 5



Diagrams of acid-values in the gastric contents I, recovered from the fasting patient, II, recovered after the test breakfast, III, recovered after the test dinner Black free hydrochloric acid, white total acidity

resected piece did not show any traces of cancerous degeneration

Gluzinski's test is a test of function, which demonstrates the failing ability of the mucous membrane to secrete hydrochloric acid

But this failing ability may be found also in other conditions than those prevailing during the development of a cancer. Further experience will show which are those conditions

It only confirms the statement made by Dr W Mayo that the "early diagnosis of cancer does not depend on any sign or symptom due to the cancer itself"

By examining 25 cases of *gastric ulcer* we found that all of them but one⁸ reacted in the manner described by Gluzinski and Kocher as being characteristic of ulcers of the stomach, to wit with a decided increase in the percentage of the hydrochloric acid and of the total acidity

After ingestion of the beefsteak rather high values of hydrochloric acid are obtained, and this is possibly most pronounced in those cases in which the dyspeptic symptoms are most severe (see Fig 4)

So strongly pronounced and so apparent has this phenomenon been in our cases that it possibly may be used as a differential symptom in the diagnosis between ulcer and other diseased conditions of the gastro-intestinal tract attended by dyspepsia

Thus in two cases referred to us from the medical ward with the diagnosis of callous ulcer—in one of them this was even the Röntgen diagnosis—we found hypo-acidity with very little increase after the test dinner

In none of them was ulcer found at the operation. A few adhesions between the duodenum and the gall-bladder were separated and both patients have later informed us that they

⁸ Male aged forty-four years. The hydrochloric acid percentage after the beef-meal decreased a little, while the total acidity increased. The difference was, however, slight and at the operation it could not be decided whether a cancer positively was developing or not, as the stomach was imbedded in a mass of firm perigastric adhesions

have got rid of their previous very severe symptoms after the operation

On Fig 5 I have given a graphic diagram of the acid values found in some cases of gall-stones examined according to Gluzinski's test

By comparing the columns with those belonging to ulcer cases (Fig 4) the difference will seem striking

In our 9 examined cases of duodenal ulcer the hydrochloric acid values were not as high as in gastric ulcer and the increase in the percentage of free acid in the second meal was moderate in 7 cases, while it was relatively great in two cases

But the difference in this respect between gastric and duodenal ulcer is not great enough to be made use of as a means of differential diagnosis

We have tried to differentiate between various forms of appendicular dyspepsia, but have as yet obtained no definite results

In our opinion Gluzinski's method is better than any other for testing the secretorial function of the stomach

Thus, in cases where free hydrochloric acid apparently is absent and not to be found after an Ewald's test breakfast, the second meal in some cases will produce a gastric juice containing hydrochloric acid

As a whole, we have found Gluzinski's test reliable. It ought to be used as a help to make the differential diagnosis in doubtful cases of gastric ulcer

A METHOD OF SUBTOTAL GASTRECTOMY *

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I AM emboldened to bring the operation described in this paper to the attention of the Association because of the difficulties that are sometimes experienced, after partial removal of the stomach, in joining the first segment of the jejunum with the posterior wall of the gastric stump, and because of the obvious disadvantages of the simpler but more dangerous anterior, antecolic, long-loop gastro-enterostomy Billroth's first method (end-to-end anastomosis between the stomach and the duodenum) and Kocher's implantation of the open end of the duodenum into the posterior wall of the stomach are, I imagine, rarely considered at the present time, owing to the great tension exerted on the anastomotic sutures, especially if one removes as much stomach as is demanded in the modern operation for carcinoma of the pylorus

The method of subtotal gastrectomy that I desire to submit for criticism consists in removing the diseased segment of stomach from left to right, after performing an end-to-side anastomosis between the lower portion of the incision, which amputates the stomach and the upper part of the jejunum, the operation being so conducted that the suturing necessary to unite the stomach to the intestine is completed before either viscus is opened

The gastric artery is doubly ligated at the upper end of the proposed line of section of the stomach, and divided between the ligatures The gastrohepatic omentum is tied in sections and severed The left gastro-epiploic artery is ligated about one-half inch on each side of the lower end of the proposed line of section of the stomach, and the segment of artery between the ligatures excised The gastrocolic omentum is tied

* Read before the American Surgical Association, April 9, 1914

and cut, from a point about two inches to the cardiac side of the selected line of gastric amputation to the duodenum. The transverse mesocolon is drawn taut, without pulling the colon from the abdominal cavity, and a hole torn in this membrane, from the upper side, within the arc of the midcolic artery. The upper end of the jejunum immediately bulges into this opening and is drawn into the lesser peritoneal cavity. A suture is passed through the greater curvature of the stomach, midway between the ligatures on the left gastro-epiploic artery, and through the antimesenteric border of the jejunum, at a point about five or six inches below the origin of the jejunum, the distance varying according to the degree of dilatation of the stomach. By pulling upward on this suture the posterior wall of the stomach and the upper segment of the jejunum are brought in contact. A suture uniting the posterior wall of the stomach to the intestine is inserted about three inches above the original suture, and a third suture is passed through the posterior wall of the stomach alone, an inch or more above the second suture (Fig 1), both of these sutures being on the line through which the stomach is to be amputated. Two sutures are now placed in the anterior wall of the stomach, at points corresponding to the upper sutures in the posterior wall (Fig 2). The point at which each anterior suture is to be inserted may be determined easily by grasping the stomach with the left hand in such a way that the index finger presses the point of insertion on the posterior wall up against the corresponding point on the anterior wall, which point is marked by the thumb. Suture *A* is now drawn upward and to the right (*i e*, toward the patient's right shoulder), sutures *B* and *D* downward and to the left (*i e*, toward the patient's left hip) and tied together, sutures *C* and *E* likewise downward and to the left and tied together (Figs 3 and 4). The upper segment of the jejunum is thus surrounded by the stomach, the anterior wall of which lies against the right side of the bowel, the posterior wall against the left side of the bowel. Between sutures *B*, *D* and sutures *C*, *E* the anterior and the posterior walls of the stomach are in contact, which contact is made

permanent by the introduction of a seroserous suture of celluloid thread, which suture is continued from *B, D* to *A*, uniting the anterior wall of the stomach to the bowel, and from *A* back to *B, D*, uniting the posterior wall of the stomach to the bowel (Fig 4) This seroserous suture is overlaid by a through-and-through catgut suture, and sutures *B* and *D* cut off short The greater curvature of the stomach is grasped with forceps about one-half inch from *A* (Fig 5), and the lesser peritoneal cavity filled with gauze The portion of the anti-mesenteric border of the intestine exposed between the rows of sutures is excised, and an incision made in the stomach close to the suture line, beginning at *G*, passing between *A* and *F*, and ending at *H* (Fig 5) After ligating any vessels which have not been caught by the sutures, thread *A* is cut and the stomach allowed to straighten itself (Fig 6) A clamp is placed across the stomach to the pyloric side of the line of section, and the amputation completed after approximating the anterior and the posterior walls of the stomach, between *J* and *K* (Fig 6), by several through-and-through sutures of catgut, which sutures are buried by an inversion seroserous suture of celluloid thread It is well, but not essential, to insert the uppermost inversion suture before completing the amputation of the stomach, since by pulling on this suture the raw edges, which are already inverted at the lower end (*J*, Fig 6), recede between the serous coats, which can then be rapidly sutured (Fig 7) The pyloric segment of the stomach is drawn from the abdominal cavity and turned over on the patient's right hypochondrium, the superior pyloric and the gastroduodenal arteries secured above and behind the pylorus, the duodenum severed between ligatures, and the duodenal stump inverted The edges of the rent in the transverse mesocolon may be attached to the jejunum or, if there is much gastrectasia, to the stomach

The operation just described may be performed in any case of gastrectomy in which posterior gastro-enterostomy is applicable, and perhaps in some in which, owing to the small size of the gastric stump, posterior gastro-enterostomy would

FIG 1

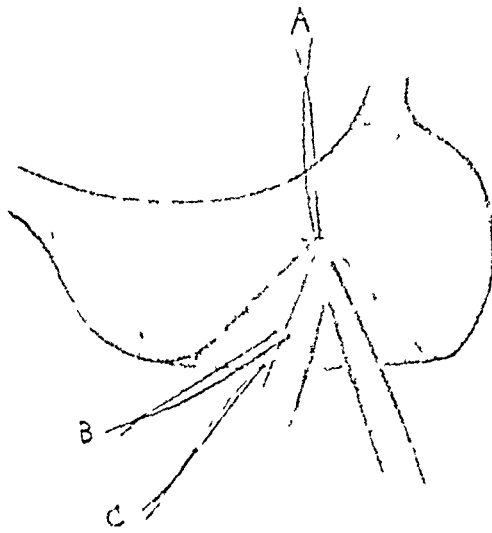


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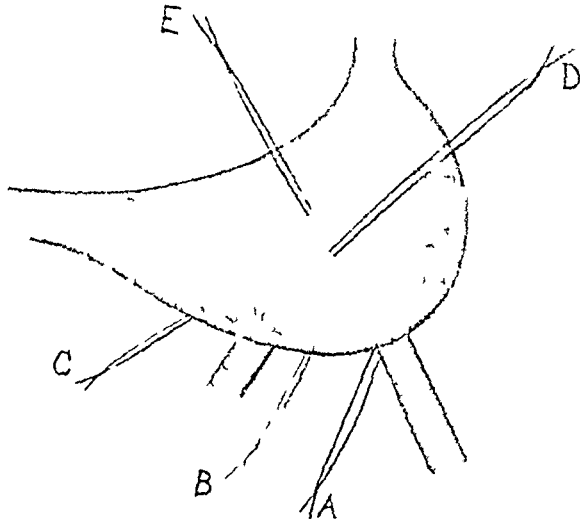


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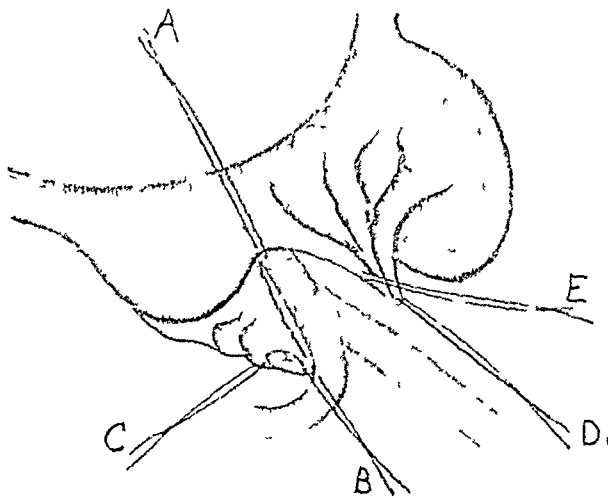


FIG 4

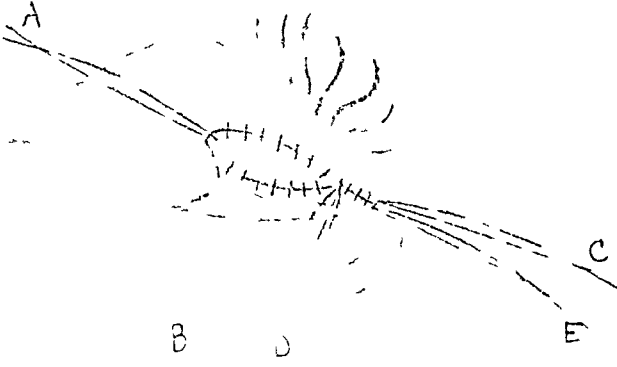


FIG 5

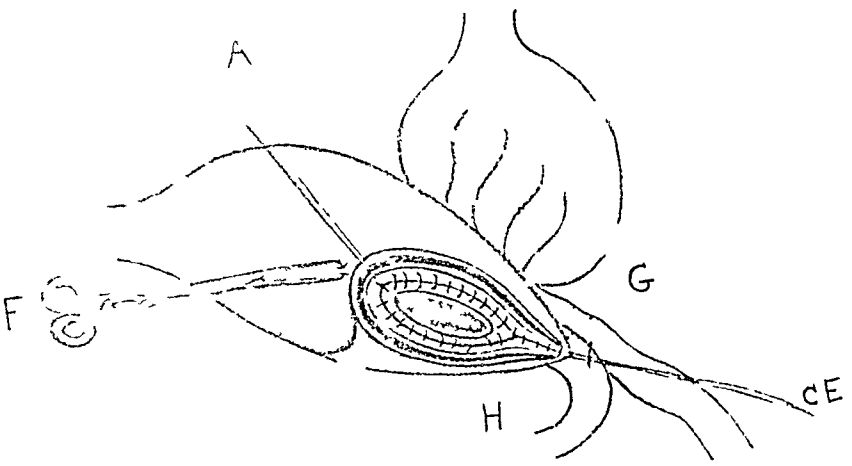


FIG 6

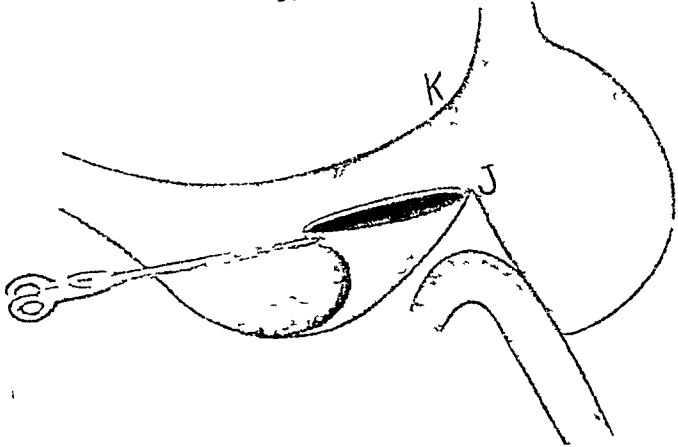
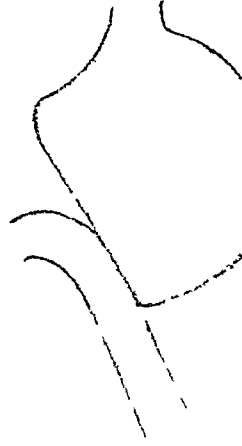


FIG 7



be injudicious. With equal practice in the two operations the newer one should be less difficult and more rapid, there is less cutting to be done, consequently less suturing, the lower part of the incision for amputating the stomach serves at the same time for the anastomotic opening. In the newer method the anastomotic opening is at the lowest part of the stomach, and all of the anastomotic sutures and a portion of the sutures which close the stomach above the anastomosis, are in place before either the stomach or the intestine is opened. When the incisions are made the cut edges are in view, unrestrained by clamps, so that hæmostasis may be made absolute. Gastro-enterostomy with clamps is often followed by bleeding, and sometimes by a hemorrhage which necessitates reopening of the abdomen. I suspect also that the bruising exerted by clamps may be partly responsible for some of the cases of non-union of the sutured surfaces after gastrectomy for carcinoma, and perhaps also for some of the ulcers which occur at or near the line of anastomosis after gastro-enterostomy for peptic ulcer. Aside from these disadvantages which attend the use of clamps, they are always in the way, and occasionally, during gastrectomy, the one placed on the cardiac end of the stomach slips, especially when it is turned to facilitate suturing. If the stomach is well cleansed by gastric lavage previous to operation, if the patient is not allowed to retch during operation, and if the guide sutures are kept taut, and the site of anastomosis is well elevated above the incision in the abdominal wall, there is no danger of leakage from either the stomach or the intestine in the method I have just described. With this method there is less tension on the anastomotic sutures and less tendency to kinking than when the jejunum is anastomosed to the posterior wall of the stomach at a point which must, of necessity, be farther to the patient's left. In posterior gastro-enterostomy after partial gastrectomy there may be, from a theoretic stand-point, some danger that the gastric incision for anastomosis, which is usually parallel or nearly parallel with the sutured edges of the stomach at the line of amputation, may interfere with the blood supply to these sutured edges.

THE FUNCTION OF THE GASTRO-ENTEROSTOMY OPENING IN CASES OF PERMEABLE PYLORUS.*

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WHAT becomes of the gastrojejunal mouth and how does it work in case of a permeable pylorus? Such are the two points to which I wish to draw attention

I *Does the gastro-intestinal mouth obliterate anatomically in case of patulous pylorus?* Kelling,¹ in Germany, suggested that in cases where the pylorus is free, the gastro-intestinal opening might be subject to anatomical obliteration in consequence of the fact that the chyme passes through the pylorus and does not pass through the artificial opening His opinion has been accepted in France by Tuffier,² Reynier,³ Jaboulay,⁴ Mathieu,⁵ Ricard,⁶ and is almost general

Personally, I disagree with this opinion, being unwilling to admit that the anastomosis thoroughly lined by a mucous membrane and free from any scar tissue should become obliterated merely because of its non-use This would be against all the rules of general pathology

When we refer to the cases of anatomical obliteration of the gastro-intestinal anastomosis, we see that these obliterations are in no way connected with the permeability of the pylorus

In 45 cases of anatomical obliteration of the gastro-intestinal mouth, which we gathered in literature, we only found 4 cases of permeable pylorus In 7 cases the cause of obliteration has been undoubtedly the secondary development and the cicatrizing of a peptic ulcer of the gastrojejunal mouth (Kauffmann,⁷ Kronlein,⁸ Navarro,⁹ Gosset,⁹ Leriche,⁹ Oviatt¹⁰) In the 34 other cases the mechanism of the obliteration appears less distinctly We observe, however, that in 23 cases buttons were used (Bérard ¹¹ 1 case, Czerny ¹² 4, Ettlinger ¹³ 1, Feldmann ¹⁴ 1, Ferrari ¹⁵ 2, Jaboulay ⁴ 1, Kehr ¹⁶ 1, Leriche ¹⁷ 1,

* Read before the American Surgical Association, April 10, 1914.

W Mayo¹⁸ 4, Moynihan¹⁹ 2, Schloffer²⁰ 5), that in 4 cases sutures were used (Eiselsberg,²¹ Hartmann, Ricard, Tuffier), and that in 3 cases Y-shaped gastro-enterostomy was performed (Fedoroff,²² Monprofit, Roux) In the last 4 cases technical details are lacking

Briefly then

(1) The obliteration of the gastro-intestinal mouth is in no way connected with the more or less permeability of the pylorus

(2) Undoubtedly the obliteration results sometimes from the cicatrization of a peptic ulcer having developed itself in the mouth

(3) The technic used has a direct bearing on the result Obliteration of the anastomosis is exceptional in cases not operated with button or by the Y-method On the other hand, the integrity of the anastomosis has been anatomically ascertained in cases of pylorus functionless, by Henck,²³ after 3 months, by Scheuen²⁶ after 28 months, by Busch²⁵ after 6 years, by myself after 5 years

II *Are the gastro-intestinal anastomoses functionally useless in cases of permeable pylorus?* In 1908, after summarizing the experiments made by Blake and Cannon, Leggett and Maury, Kelling, Delbet, Tuffier, adding to these experiments some radiosopic examinations on men, two observations of duodenal fistula by Berg, in which all the gastric contents passed through the fistula notwithstanding a gastro-enterostomy, Guibe²⁶ concludes "All the experiments on animals and observations on men seem to agree sufficiently to prove that as long as the pylorus remains permeable, the stomach has an almost invincible tendency to drive out its content through this orifice without being inclined to utilize the artificial mouth Nothing whatever passes through the new opening, on the contrary, everything passes through the pylorus"

This opinion, clearly expressed, may be considered as generally accepted, even up to this day

However, when we read the reports of the radiologists, we see that the facts do not agree absolutely with these con-

clusions Legueu²⁷ observes that in a case of permeable pylorus all the gastric contents pass through the mouth Berard and Delbet²⁸ have shown us that the gastric contents pass as well through the mouth and through the pylorus Pess,²⁹ after having studied 40 gastro-enterostomies by the X-rays, comes to the conclusion that the stomach (its pylorus being permeable or not before the operation) empties itself continually by the mouth and by the pylorus Gray,³⁰ in a case of ulcer without stenosis, finds that the gastric contents pass specially through the mouth Petrév³¹ examines 9 cases of gastro-enterostomy for gastric lesion with integrity of the pylorus, 4 times all the gastric contents passed through the mouth, twice through the pylorus, 3 times through the pylorus and through the anastomosis In 4 cases of normal pylorus, Hartel³² finds that the evacuation takes place as well through the pylorus as through the mouth (1 case 2 years, and one 7 years after operation) Hesse³³ finds in 9 patients that the gastric contents pass through the mouth and through the pylorus

These quotations prove sufficiently that the opinion of those who affirm the functional uselessness of the gastro-enterostomy in cases of permeable pylorus, is not as exact as they suppose, and that it is necessary to modify their too absolute affirmation

To elucidate the question, I have made two kinds of researches.

- 1 Experiments on dogs
- 2 Radiological examinations of patients

EXPERIMENTS ON DOGS (IN COLLABORATION WITH MY PUPIL, M METIVET)

Dog 1—Gastro-enterostomy joining the terminal portion of small intestine and pyloric antrum Section of the intestine above the anastomosis suturing its proximal end to the skin, closing its distal end

The dog lived 13 days without expelling any faeces through the rectum We supposed that the anastomosis had not acted At the post-mortem, we found a stomach containing intestinal fluid, the efferent portion of the intestine being empty, and numerous adhesions at the point of the anastomosis The fluid introduced into the stomach passed with much difficulty through the mouth

Dog 2—Gastro-enterostomy between the initial portion of small

intestine and the fundus of the stomach Thirty-seven days later, the dog is vomiting intestinal liquid and shows all the symptoms of intestinal obstruction Next day we gave it 300 gr of milk and half an hour later we killed it At the post-mortem the stomach contained a yellowish fluid of fecal odor with clots of milk This did not pass either into the duodenum, nor into the jejunum The mouth was anatomically in good condition but obliterated by a bone which was impacted in its aperture and obstructed, on the other hand, the intestine The intestine was distended by the liquid reaching the point of anastomosis and was contracted just behind the anastomosis

Dog 3—Gastro-enterostomy between the initial portion of the jejunum and pyloric antrum Forty-four days after the operation the intestine is cut just above the anastomosis The end in connection with the anastomosis is closed and the duodenal end is fixed to the skin

The next day a meal composed of milk and hashed meat is given to the dog, which it eats with good appetite After 7 or 8 minutes some bile is coming out of the duodenojejunal opening and 15 minutes afterwards a few small curds of milk mixed with the bile Half an hour after the meal the dog is killed In the duodenum some bile and a few curds of milk are found representing what has passed through the pylorus In the jejunum, at a distance of about 65 to 70 cm one perceives a quantity of clots of milk and some particles of meat, showing what has passed through the gastro-intestinal mouth, which is normal, the pylorus likewise

Dog 4—Gastro-enterostomy between the initial portion of the jejunum and the pyloric antrum Forty-six days after the operation, the intestine was cut above the anastomosis, exactly as in the former cases, the end attached to the stomach was closed, and the duodenum fixed to the skin

After 3 days, 400 gr of milk were given, 10 minutes later, a small quantity of milk was flowing through the duodenal fistula The animal was killed 20 minutes later In the duodenum we found some curds of milk which had passed through the pylorus In the jejunum, for a distance of more than 1 metre, the intestine was full of curds of milk Artificial opening and pylorus both normal

Dog 5—Gastro-enterostomy between the jejunum and fundus of the stomach After a month, section of the intestine above the anastomosis, closing the gastric end and fixing the duodenal end to the skin

The next day 400 gr of milk and hashed meat is given to the dog After two minutes and a half, milk begins to flow abundantly through the duodenal opening, mixed with a few particles of meat Ten minutes later about 150 gr of milk are flowing The animal is killed 10 minutes after the meal We find in the duodenum a great quantity of milk and particles of meat which passed through the pylorus In the jejunum at about a distance of 10 to 20 cm we see some clots of milk and some particles of meat, representing all that had passed through the anastomosis Artificial opening and pylorus both normal

Dog 6—Gastro-enterostomy between the initial portion of the jejunum and the fundus of the stomach Thirty days after the operation,

after having removed an adhesion, which united the anterior part of the stomach with a point of the efferent part of the jejunum, situated 9 cm below the anastomosis, we cut the intestine across above the anastomosis, closing the gastric end and suturing the duodenal end to the skin

The next day a meal of milk and hashed meat was given to the dog. Seven minutes later, the milk and some particles of meat were passing through the duodenal aperture. The dog was killed half an hour after the meal. The duodenum contained some curds of milk and some particles of meat, the jejunum contained milk and meat in its first centimeter. Gastro-anastomosis and pylorus both normal.

Dog 7—Gastro-enterostomy between the initial portion of the jejunum and the pyloric antrum. Two hundred and twenty-three days after the operation, second operation (June 22, 1912). Section of the jejunum above the anastomosis, closing the gastric end and suturing the duodenal end of the skin. 20 cm below the anastomosis, the jejunum is cut through a second time, closing the distal end and fixing the proximal to the skin.

The next day, 100 gr of milk is given to the dog, 1 minute later liquid begins to flow through the jejunal fistula (corresponding to the anastomosis), 2 minutes and a half later a large amount of bile is flowing through the duodenal fistula. These liquids are collected and preserved. About a quarter of an hour later, the liquid coming from the jejunal fistula is no longer clear, a fresh sample is put aside. These different liquids are analyzed by W. Fabre. During the first quarter of an hour, bile flowed through the duodenal fistula and acid liquid through the jejunal fistula. After a second quarter of an hour, bile was coming through the duodenal fistula, the jejunal fistula giving a liquid containing ozazone (specific of lactose) which W. Fabre could not find in the bile coming through the duodenal fistula. Next day half a pint of milk is given to the dog. It is killed an hour later. The stomach contains an almost clear liquid with some curds of milk, the duodenum is full of bile and some few curds of milk. The piece of jejunum connected with the gastric mouth is full of curds of milk. The mouth is normal, so is the pylorus.

In none of these experiments did we find the mouth obliterated, nor thickened, even after having kept the dog alive during a long time, 223 days in one case.

As for the functions of the mouth, we may leave aside the experiments 1 and 2. In the first, function was prevented by adhesions and angulation, in the second, the dog died the thirty-seventh day in consequence of an intestinal occlusion produced by a bone obstructing the mouth and the intestine just in front of it.

In 2 cases, in which the mouth was made on the fundus, the gastric contents passed at the same time through the mouth

and through the pylorus, but the greatest quantity through the latter

In 3 cases, in which the anastomosis was made on the antrum, 44, 50 and 223 days after the operation, the gastric contents (milk and meat) passed through the artificial mouth almost entirely

These experiments show that the evacuation is done principally through the anastomosis if it is situated on the pyloric antrum, through the pylorus if it is situated on the fundus of the stomach

If previous experimentators saw the gastric contents passing almost altogether through the pylorus, it was probably because of their having made the anastomosis on the fundus of the stomach. It is the fundus which presents when opening the abdomen of a dog, and it is this part of the stomach which is brought out. Therefore, it is the natural portion used for anastomosis. The pyloric antrum, on the contrary, is situated deep under the liver and it is necessary to pull it out to bring it to light. It is, therefore, only when one has the fixed intention of making the anastomosis on this part that one is at all likely to do so.

Most probably Kelling, Delbet and Tuffier operated on the cardiac part of the stomach. As for Tuffier,³¹ we are quite sure of it. He says "I remind you how easy it is to observe on a dog, making use of X-rays, that everything passes through the pylorus, because we know, when operating on a dog, that the new pylorus can only be placed at a distance of 25 cm from the normal pylorus and not less."

In the experiments on cats of Cannon and Blake, 8 times gastric contents was forced out naturally by peristaltic waves through the pylorus, only 2 exceptions were observed, food leaving by both exits, in one of these two cases the stoma was in the posterior wall of the antrum close to the pylorus, in the other about half-way between the two ends of the stomach.

Calabrene, who paid attention to place the mouth near the pylorus, notes that the contents of the stomach pass through the anastomosis

These different modes of evacuation of the gastric contents, according to the position of the artificial opening, find their explanation in the differences of the muscular contractions in the different zones of the stomach. In order that the gastric contents may pass from the stomach into the intestine, the pressure to which it is subjected must be greater than that of the intestinal contents.

Experiments show us that the pressure, which is very weak in the fundus, gets stronger in the antrum and that even in the latter it is subjected to considerable variations, getting considerably stronger at the very moment of the gastric contractions. Von Pfungen, in 1887, measured intragastric pressure on a boy with a gastric fistula. The pressure in the fundus varied only from 5 to 10 mm, in the region of the pylorus, the pressure was greatly increased and varied from 40 to 80 mm mercury, in connection with its peristaltic contractions.

Hofmeister and Schutz had observed likewise a very great difference in the form of contractions of the two parts of the stomach, in their experiments on dogs. Moritz has seen, in his observations on men, that as far as the left part of the stomach was concerned, he observed only very rare and slight variations of pressure, from 2 to 6 cm of water, meanwhile, he found that in the pyloric region the energetic contractions of the gastric muscle were very frequent, and capable of making the water rise up to 50 cm.

All the investigations agree to make us consider, with Gray and others, that the stomach consists of two parts, the cardiac part acting as a reservoir and the pyloric part as a motor.

One understands, therefore, that the juxtapyloric anastomosis works actively even when the pylorus is normal, and that the anastomosis on the cardiac part is functionless in cases of a permeable pylorus.

Radiological Examinations (in collaboration with Dr Maingot, radiographer of the Loumec Hospital and Wolfram, junior demonstrator in anatomy) —The radiological examina-

tions on man have confirmed the results of the experiments on dogs. Our anastomoses have almost always been placed on the lowest part of the pyloric antrum. In consequence, we observed that the evacuation of the gastric contents takes place partly through the anastomosis, partly through the pylorus.

To be quite certain of the exact point of passage of the bismuth, the examination of a skiagram is insufficient. In cases where the bismuth has passed through the pylorus, it happens that the skiagram shows a loop leaving the greater curvature and giving the illusion of a passage through a gastro-intestinal anastomosis, whereas this appearance is due to the fact that the initial portion of the duodenum is overshadowed by the stomach, the jejunal shadow only separating from that of the stomach below the greater curvature. It is indispensable to make a skiascopic examination. One then sees the bismuth pouring into the stomach and passing through the anastomosis before reaching the pylorus. In this way it is impossible to mistake the evacuation through the anastomosis for an evacuation through the pylorus.

The evacuation through the anastomosis does not always take place in the same way. On 19 of our patients without a sign of gastric stasis before the operation and no sign of pyloric stenosis during the operation, we observed after intervals varying from 1 to 11 years

Once, everything passed through the pylorus, 11 times everything passed through the anastomosis, 7 times the bismuth passed both through the anastomosis and the pylorus.

Sometimes, the passage was almost immediate, in other cases the passage took place by instalments, succeeding each other at short or long intervals, in some cases the evacuation began with a gush and continued by repeated instalments.

The results of radioscopic examinations are therefore in accordance with the results of the experiments and show that, in opposition to the general opinion, the gastro-intestinal anastomosis may work even in cases where the pylorus is patulous.

We have found these results interesting enough to draw your attention to them even if they have not considerable practical importance and if they do not prevent many surgeons from continuing to exclude in many cases the pylorus

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CHRONIC PANCREATITIS.*

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As a direct object of surgical attack the pancreas remains to-day the most unpromising of all essential organs. Complete removal is homicidal, partial excision is difficult and but rarely indicated by the character of its diseases, and direct drainage can be accomplished only in very imperfect fashion at best. In the past few years much has been added to our knowledge of pancreatic disease, its frequency and its pathogenesis. As surgeons we should derive some therapeutic gain. It is in the hope of clarifying our position in respect to chronic pancreatitis that we offer these brief observations.

Our difficulties in dealing with chronic pancreatitis are greatly increased by the fact that we possess no definite syndrome of signs, symptoms or laboratory tests by which an early clinical diagnosis can be made and the situation is further complicated by the existence of the disease in two chief forms, one of which involves particularly the interlobular septa and the parenchyma of external secretion, while the other attacks chiefly the islands of Langerhans and only in lesser degree the secretory tubules and interlobular structures. In the interlobular form of the disease digestive symptoms predominate. In disease of the islands of Langerhans, as is well known since the researches of Opie, disturbance of carbohydrate metabolism results, manifesting itself in the more pronounced cases as diabetes. Both these processes when clinically recognizable and demonstrable are characterized pathologically by parenchymatous degenerations of advanced degree and the deposit of fibrous tissue and fat in the gland.

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When this state of affairs is present it is useless to expect cure in the sense that the damage done may be repaired or even compensated for in any marked degree. It is quite comparable to chronic nephritis of the type characterized by deterioration and degeneration of the renal cells with interstitial fibrosis. Partial or complete arrest of the process may at times be effected by removal of the cause of the disease or by careful palliative treatment along empirical lines. But for practical purposes we may consider such cases as having acquired a chronic condition that will necessitate at best a degree of invalidism and in general will sooner or later, directly or indirectly, be responsible for the death of the individual so affected. We have on a number of occasions had the opportunity of reopening the abdomen in a case the subject of chronic indurative pancreatitis and in no instance have we witnessed a return to a normal condition. We have also operated upon a number of cases of diabetes in which there was good reason to believe that the process was inaugurated by inflammation of the biliary passages. In no case of well established diabetes did a cure of that condition result, so far as we are able to determine. On the other hand, transient glycosuria, present during exacerbations of biliary and pancreatic disease, we have seen entirely relieved by appropriate operative treatment of the underlying condition. These experiences clearly point the lesson that treatment of the chronic form of pancreatic disease must be directed at the early stages if it is to be effective. We must prognosticate the probable course of early lesions and act with promptness in order to prevent their development.

Owing to the inaccessibility of the pancreas and the difficulties of observation, the slow transitional gradations from early lesions to late effects have never been followed in the individual, nor has a complete series of changes been compiled by the pathologist because of scantiness of early material, and the difficulty of study of finer parenchymatous changes, owing to the self digestion of the organ which begins probably in the agonal stage and rapidly proceeds in the first few hours after

death We must, therefore, have recourse to deduction based upon operative findings, clinical experiences and, only to a lesser degree, upon the late findings of the mortuary

Several facts have been established First, a very considerable proportion of pancreatic inflammation is associated with, and in all human probability secondary to inflammatory lesions of the alimentary tract and its derivatives The biliary tract and the duodenum head the list by reason of their contiguity There is reason to believe that the stomach, the appendix and possibly the colon and remainder of the intestine may at times be primarily responsible

The second fact of importance and one which has been repeatedly verified is the common involvement of the head of the pancreas and the relative immunity of the body and tail of the organ in inflammations transmitted to it from an inflamed biliary tract or duodenum As we have pointed out previously, this behavior does not square with the current conception of the pathogenesis of pancreatitis, namely, that it is in the majority of cases a duct borne infection It is difficult to conceive of an infection of the ducts which could so generally select but one portion of the duct distribution as its seat, to the exclusion of the other areas communicating just as freely with the terminal ducts of discharge Would we not rather believe on anatomical grounds that the head of the pancreas would show the lesser lesions, since in a considerable proportion of cases it possesses an additional functioning path of discharge of its secretion through the duct of Santorini, which can in no way be affected by what has been aptly termed the "unfortunate association of terminal facilities" of the duct of Wirsung and the common bile duct?

A better explanation of the early pancreatic swellings and inflammations seen at operation exists in the close association of the lymphatics of the gall-bladder, the liver and the duodenum with those of the head of the pancreas In former communications we have described the lymphatics leading from the gall-bladder, the bile ducts and the duodenum in their relation to the head of the pancreas where they anastomose inti-

mately with the lymph-vessels of that organ. We have observed clinically indications of the march of the infection most typically in cholecystitis where, in sequence, we have found the inflamed gall-bladder, enlargement of the cystic lymph-gland, infiltration of the gastrohepatic omentum, hyperplasia of the glands about the common duct, peripancreatic infiltration and enlargement of the head of the pancreas. We have shown that the areas of pancreatic infection correspond with the lymphatic distribution and not with the duct distribution. For this condition we have adopted the term pancreatic lymphangitis, proposed by Arnsperger, and have suggested that the condition probably is, in a percentage of cases at least, the forerunner of the alterations characteristic of chronic pancreatitis.

This condition occurs with cholecystitis with or without stones. It is, so far as we are aware, undiagnosable, except by direct inspection and palpation at operation. It cannot, therefore, be regarded as an indication for operation except in the cases characterized by more persistent and severe exacerbations.

Our knowledge of the existence of this condition must affect our ideas of treatment in two ways. First, in emphasizing the necessity of prompt and radical treatment of abdominal diseases, particularly those of the gall-bladder, which do not yield readily to internal measures, second, in influencing our operative procedures in cases where this condition is present as a complication during operation. A recent instance of the disasters of delay in cholecystic disease is the following:

The German Hospital, white, female, thirty years old. Pain in epigastrium and back. Since July, 1913, has had nine attacks of very sharp pain, beginning between shoulder-blades, radiating front to gall-bladder area, relieved by morphia. Each attack lasts about one week, followed by soreness in upper abdomen and jaundice. March 23, had a severe attack of this pain, with chills, fever, and collapse, and uncontrollable vomiting, followed by jaundice the following day. Pain and jaundice have persisted

Bowels have been regular Stools have not been clay colored Micturition normal, but the urine is very dark

One child four months old Menses just beginning Appendicitis six years ago—not operated Abdomen palpable enlargement in epigastric region, extending into gall-bladder region

Operation (April 1) —Findings extensive fat necrosis and acute suppurative pancreatitis, pus confined to lesser peritoneal cavity

Blood Count —Polynuclear neutrophiles, 87, lymphocytes, 7, leucocytic mononuclears, 9, hæmoglobin, 70, red blood cells, 4,180,000, white blood cells, 27,750

Test Breakfast —Free HCl, 41, total acidity, 90

Cambridge "C" Reaction —Negative Culture pus pancreatic Collection, no pus

Stool —Occult blood Ft positive to benz, negative to guaiac Bile vert ft positive

The effect of our knowledge of the dissemination of infection by way of the lymphatics has been to diminish our faith in simple drainage of the gall-bladder or ducts as a cure-all for biliary and pancreatic infection It is well known that there is a percentage of recurrences of biliary infection after drainage operations This is more common in simple cholecystitis than in calculous disease of the gall-bladder or ducts In a considerable number of cases obstruction of the cystic, common or hepatic ducts seems to play no part At least there is no evidence of obstruction in the shape of a demonstrable cause or in dilatation of the ducts by back pressure In such cases, however, mucosal and interstitial infection of the wall of the gall-bladder may be present If it is not dependent upon intermittent or constant obstruction for its foothold it is not likely that freer drainage will completely dislodge it and it is in these cases that our operative results have proved most unsatisfactory from the stand-point of permanent cure It is true that some cases are cured and the majority benefited temporarily by simple cholecystostomy, and reasoning along these lines it has been proposed to do cholecystoduodenostomy, -gastrostomy or -enterostomy in cases complicated by chronic pancreatitis, with the idea of providing permanent free drainage Unfor-

fortunately for the idea it has been found that such a fistulous opening does not remain permanent in the absence of an obstruction to the natural course of the bile. There is but one course open, therefore, which is the removal of the gall-bladder, in which, as a rule, the lurking place of the infection is found. While for years we defended cholecystostomy and decried cholecystectomy except for the most evident indications, we have come to believe that the field for cholecystectomy should be widened and that all gall-bladders should be removed that show evidence of chronic infection independent of obstruction and particularly so if the pancreas is involved. We believe also that in calculous cholecystitis, which shows evidence of marked interstitial disease and disseminated lymphangitis the chances of permanent cure are enhanced by cholecystectomy.

Naturally in each case good surgical judgment will weigh the increased immediate danger of an operation of greater magnitude against the question of permanence of results. In suitable cases with good technic we do not believe that the danger will be much, if at all, increased by cholecystectomy. Such has been Kehr's experience. In this country cholecystectomy has had a distinctly higher mortality, which is due chiefly to the fact that it was reserved for more serious and complicated cases. Still, in the presence of great operative difficulties or when dealing with a poor surgical risk, we would not advocate cholecystectomy for these indications, since simple drainage cures many and it is our creed, frequently stated, that a living patient after two operations is better than a dead patient after one thorough operation.

Another point of great importance is drainage of the common duct in connection with cholecystectomy. This is best done with the T-tube. It should never be omitted for the reason that it greatly diminishes immediate danger and renders recurrence less likely. We always run a risk of misinterpreting the basic lesion and we are not willing to discard the known benefits of drainage in so many cases. It is possible also by choledochotomy to pass a searcher into the ducts and down into the duodenum and thus dismiss the possibility of stone or

stricture There is a group of obstructive cases in which the only cause that can be found is stenosis of the papilla of Vater Whether this is due to a spasm of the sphincter of Oddi or to inflammatory changes in the tissues surrounding the orifice is not definitely known in all cases Certainly many are inflammatory and particularly those cases of complete and lasting obstruction associated with jaundice cannot be interpreted as sphincterismus It seems not unlikely, however, that spasm of the sphincter does occur and is productive of symptoms Divulsion of the papilla by a large searcher or gall-stone scoop is curative in these cases When the gall-bladder is removed we must realize that we are taking away the "tension bulb" of the biliary tract, the mechanism by which transient back pressure is prevented from exerting its full effects upon the liver directly It is of paramount importance, therefore, to be sure that nothing exists in the nature of an obstruction to the free discharge of bile into the duodenum Slight or intermittent obstruction at the papilla is not sufficient to enable the surgeon to recognize the condition by the appearance of the common duct and it is therefore wiser to eliminate it in the manner here suggested

Finally, it must be said that the most important message that the surgeon has for the profession, as the result of the increase of knowledge of pancreatic disease made possible by the autopsy *in vivo*, is the necessity of referring intractable dyspeptics to the surgeon It is not enough that the internist by diets, drugs and trips to Carlsbad, French Lick Springs and the like can lull infected gall-bladders and ulcerated duodenums into temporary quiescence If by recurrences and chronic disturbances it is evident that sterilization of the infected area has not been accomplished, he should realize that he is exposing his patient to the most serious damage to the parenchyma of essential organs which can never be repaired

SUGGESTIONS REGARDING THE ANATOMY OF AND THE SURGICAL TECHNIC IN THE TREATMENT OF JONNESCO'S MEMBRANE.

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IN a paper which I read before the Surgical Section of the American Medical Association at its last meeting in Minneapolis, entitled "Surgical Aspects of Intestinal Stasis, from an Anatomic Point of View," I asked discussion upon the following points

1 If the Jonnesco-Jackson-Reid membranes are congenital, are they always more or less clearly demonstrable in every individual, should the incision admit?

2 Are the membranes purposive? If so, are they not intended by nature as ligamentary supports—preventive of intestinal stasis rather than causative?

3 Therefore they should be divided only after they have become restrictive of intestinal function, from loss of nervous and muscular tone resulting from chronic intestinal toxæmia

4 Is the method of demonstrating the so-called "white line" always reliable? If so, does not this in itself prove the congenital origin of the membrane and its physiologic importance?

I believe that every thinking, informed man to-day should concede that all of these membranes are congenital, the demonstrations by Flint, Rilus Eastman, and others, clearly show this, and I have had so much personal corroborative evidence that these membranes can be demonstrated to a greater or less degree in every abdomen when the incision admits of a thorough inspection, that I am no longer in doubt as to this, to me, established fact, and many of my friends are agreeing with me—some of them men of the widest experience in abdominal

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surgery As Sir Arbuthnot Lane in one of his papers writes, "acquired mesenteries and adhesions," as he is pleased to call them, "were absolutely and categorically denied by physicians experienced in post-mortem work, who appeared to think that, because they had escaped their observation as many things have done and will continue to do, they were justified in denying their existence in the most dogmatic manner possible" Many of these friends of mine who now agree with me as to the position that I take in this matter, formerly smiled, if they did not disagree Now that they are looking for themselves they see with the same eyes that I do The study of anatomy at the operating table has impressed me more and more, that the viscera of men differ in as great a degree as do their faces—there are no two exactly alike

If the Jonnesco-Jackson-Reid, etc, membranes are congenital and always more or less clearly demonstrable, then they *must* be purposive and intended by nature as an aid in carrying out the function of the bowel, and it is only when the arrangement of these membranes is at variance with the conduct of the normal function of the bowel, that the membrane becomes pathological, and this arrangement may be defective or restrictive—defective when the bowel is not properly supported, restrictive when its function is restrained or inhibited Neither of these conditions is apt to be observed in childhood The muscular tone is so positive in childhood and youth that the peristaltic action of the intestine overcomes minor difficulties It is only when this tone, from physical conformation of the skeleton, habit, or long continued over-strain, becomes lessened, that a too loosely supported bowel or a too tightly restricted bowel is unable to functionate without the development of more or less intestinal stasis with its accompanying symptoms As Mr Gray puts it (*British Medical Journal*, January 24, 1914), it is the *manner* of attachment of the membranous bands to the bowel or its mesentery that causes stasis I have seen the so-called Jackson-Jonnesco membrane in a considerable number of individuals under twenty years of age, but have never seen symptoms produced in any one under

seventeen years of age Van Buren Knott tells of two infants under one year of age, with most extensive Jackson membranes, upon whom he successfully operated for intussusception, the Jackson membranes having nothing to do with the cause of the intussusception, and the infants being in good health succeeding the operations, with normal bowel function Most of the cases that I have observed where abdominal symptoms were dependent upon *defective* or excessive envelopment of the bowel in a so-called Jackson membrane, were in people over thirty years of age, and in several they have been between fifty and sixty years of age The intestinal wall loses its tone just as the bladder may lose its tone from the various causes that produce it Therefore, two lines of procedure may be required for the relief of intestinal stasis and the accompanying symptoms—the *one* to release the bowel so as to permit of freer function, the *other* to support the bowel, thereby increasing its muscular tone In excessive angulations from membranous restrictions it may be advisable to relieve the resulting stasis by an exclusion of the colon I am not as yet prepared to admit the justifiability of its excision Even without angulating bands involving the cæcum and lower ileum, stasis in the ileum may be demonstrated as caused by an incompetency of the ileocolic valve J T Case (*Medical Record*, March 7, 1914) has found by X-ray observation 250 cases of this kind in an examination of 1500 people in whom the competency of the valve was tested by the bismuth enema, and Kellogg (*Surgery, Gynecology and Obstetrics*, November, 1913) has reported a number of patients successfully operated upon for stasis of the lower ileum, the result of damming back from the colon because of incompetence of the ileocolic valve So it is again seen that congenital membranes and bands of the right iliac fossa may in themselves be innocent of mechanically causing auto-intoxication As Kellogg says, “the remarkable advances made in the technic of the X-ray study of the alimentary tract within the last few years, have rendered invaluable service in making it possible to locate the cause of obstruction in these obstinate

cases " Further experience has convinced me that the so-called "white line," which I believe to be the line of fusion of the duodenal and colonic peritoneum with the parietal peritoneum after rotation of the duodenum and colon has been completed, is always demonstrable whenever the pericolic membrane can be shown, and it is the line of attachment of the pericolic membrane to the parietal peritoneum. It is demonstrated by rotating the attached hollow viscus in a direction continuous with the course of the blood-vessels and fibres of the membrane. I have called this "white line" the *ligamentary attachment* of the pericolic membrane to the parietal peritoneum. Usually, when it may be deemed best to release the intestine from the investment of this ligamentary support—the pericolic membrane—it should be divided along its loosest line of attachment, however, greater motility may be obtained in some instances by dividing the membrane at its base—the "white line", when this line is short, as it frequently is in the hepatic region, the raw space, left by the division of the line in the direction with its course, can be closed by suturing at a right angle to the line of division. If the "white line" is a long one, as it sometimes is in an extensive membrane enveloping the ascending colon, this is not practicable. When, in addition to the presence of a Jackson membrane, there is a marked ptosis of the hollow viscera, particularly the cæcum and transverse colon, the membrane should not be divided, but some of the methods advocated by Coffey and Connell are indicated. I have found, however, in women, that a properly fitted, front-lace, straight front corset, will relieve many of the symptoms that depend upon these ptoses, provided proper habits of life are observed.

BULLET IN THE PERICARDIUM.

AURICULAR FIBRILLATION

BY GEORGE E ARMSTRONG, M D ,

OF MONTREAL

THERE was admitted to the Royal Victoria Hospital, Montreal, on Feb 17, 1913, an Italian, aged 46, complaining of a wound in his chest

He says that he was treated for pneumonia in this hospital nine years ago He has taken alcohol very freely

He stated that at 5 A M on the day of admission he was shot by his son The assailant used a 32 calibre revolver and stood in front of him and about five feet away The patient says that he was dazed for a moment and then recovered and pursued his assailant, but was unable to run far on account of weakness

He is a well-developed, well-nourished Italian He can assume any position, complains of but little pain There is no respiratory distress His general condition is good Pulse regular and not rapid There is a small punctured wound opposite to the third intercostal space and slightly to the left of the border of the sternum There is no staining or charring of the skin and but little tenderness on pressure There is no discharge from the wound and very little discomfort on taking a full breath

The chest is emphysematous, but there is no evidence of pneumothorax or of air or blood in the pericardium No murmurs can be heard nor any friction rub An examination of the abdomen was negative In the afternoon the pulse became irregular, missing every fourth to tenth beat

A fluoroscopic examination of the chest showed the bullet lying loose in the pericardium, moving with each heart beat, and changing its position with the changing position of the patient If the man lay on his right side the bullet rolled to the right, and back again to the left when the man rolled on his left side The bullet seemed to lie most naturally toward the right Marked irregularity in the pulse developed when the patient was moved frequently from one side to the other In the late afternoon a slight cough developed

During the succeeding four or five days, the only changes to be noted were increasing irregularity of the pulse and a change in his general condition. It was evident to everyone that the man was losing ground. The temperature elevation was not great, a hundred and two-fifths was the highest. The change in the pulse was definite. It became more rapid, more irregular, and smaller and more compressible. Two physicians, Drs. Martin and Hamilton, saw him with me daily and the different views soon took definite form and largely on one issue. None of us had had any experience in similar cases to guide us. The important question at the moment was, Should the bullet be removed or not? The physicians inclined to the view that the bullet had done its work. That there was, very likely, an injury to the heart, either to the auricle or to the ventricle or the auriculoventricular groove, but that the bullet now lay free in the pericardium and that it was a matter of no importance whatever to the patient whether the bullet was removed or not. Against this theory was the daily, progressive, general failure in condition and the increased rapidity and irregularity of the heart's action. The proposal to remove the bullet was finally assented to on the ground that he would be no worse afterward and might be better. A tracing showed complete auricular fibrillation.

A radial tracing showed an irregularity both in volume and rhythm, the figures under each pulse period indicate the duration in seconds. Lime marker in $1/5$ seconds.

On comparing the radial with the venous tracing it can be seen that the irregularity is not due to extra systoles. There was a marked and rapidly irregular pulsation of jugular veins in the neck. The venous tracing is of the so-called ventricular type, showing the same irregularity as shown in the radial with an utter absence of any wave due to auricular contraction. The carotid and "V" waves are the only waves represented.

This combination of an absolute irregularity and absence of any sign of a regular and definite auricular contraction can be due to only one condition, viz., auricular fibrillation.

In the afternoon of the fifth day I removed the bullet. Ether was administered by the intratracheal insufflation method.

Wilm's intercostal incision through the fourth intercostal space brought me readily down upon the pericardium. The internal mammary artery was divided between two ligatures. The pleura

was opened and the lung allowed to collapse moderately. A rib-spreader was inserted and the pericardium opened. I now passed my finger within the pericardium but could not feel the bullet, although the patient was rolled from one side to the other. A portion of the fifth rib was resected and I could then pass two fingers in and feel the bullet lying directly behind the heart. By rolling the patient well over on his left side the bullet came readily within reach of my fingers and was hooked out. There was little blood or effusion in the pericardial sac.

The opening in the pericardium was then closed with catgut sutures without drainage. A little increase of pressure in the intra-tracheal apparatus brought the lung out to the level of the incision in the chest wall, which was then closed, leaving very little if any air in the pleural cavity.

Throughout the operation for the removal of the bullet the pulse retained the same characteristics and a rate of 130 to 140, varying slightly throughout the anæsthesia. After the bullet was removed and before the pericardium was sutured the pulse obviously quieted and the rate was 120 at the carotid.

Two and a half hours after the operation the pulse was 105 and perfectly regular.

A tracing taken the same morning showed what to all intents and purposes was a normal tracing, a well-marked and large auricular wave and a large onflow wave.

The radial tracing was regular in volume and rhythm and showed a rate of 90 per minute.

CONCLUSIONS

1 Onset of auricular fibrillation in a heart where, as far as could be ascertained, there had been no previous inflammatory mischief, no symptoms of any cardiac involvement, due to the presence of a foreign body.

2 Cessation of the disorderly rhythm on the removal of the cause—the bullet.

3 A rare opportunity of observing the heart in such a rhythm.

We have been unable to find any reference in literature to a similar condition.

PULMONARY ABSCESS AND BRONCHIECTASIS.*

A CLINICAL REPORT

BY HOWARD LILIENTHAL, M D,

OF NEW YORK,

Attending Surgeon to Mt Sinai and Bellevue Hospitals

SINCE the application of intratracheal anæsthesia to the human being early in 1910, with the simplification of differential pressure methods in endothoracic operative work, I have been greatly interested in the new possibilities of lung surgery. Believing that there is a peculiar interest and value in studying the methods and results of an individual surgeon, I venture to offer a series of histories and notes representing my own work since 1910 in cases of lung abscess and bronchiectasis.

There have been a number of other thoracic cases, but I have limited this paper to a consideration of the suppurative non-tuberculous lung infections.

There were fourteen operations on eleven patients, and there were but three actually "*cured*." Two cases are still unfinished and cannot be included in my table, though I present abstracts of their histories. One patient was not operated upon.

Five operations were followed by visible improvement, and there were four deaths.

Two of the fatal cases (VI and VII) I consider to have been hopeless. One of the other two might have survived for a time (Case II) had I been satisfied with a mere "operative" recovery. Case VII might perhaps have recovered with better technic.

Of the eleven patients operated upon five had bronchiectases and of these one patient died in the hospital. The others were more or less improved. One died about a year later of hemorrhage.

* Read before the American Surgical Association, April 10, 1914

There were three cases of acute abscess and two of the patients recovered

One of chronic abscess recovered

One of acute extensive gangrene died

One of fetid bronchitis with minute abscesses died

Hemorrhage (hæmoptysis) was prominent in four of the bronchiectatic cases, and in these resections of the thorax certainly did result in benefit, in two of them the tendency to hemorrhage having been temporarily checked. Indeed, obviously insufficient operative attempts were several times followed by decided improvement, both subjective and objective (lessening of the amount of expectoration)

Clubbing of the fingers was a prominent phenomenon in the chronic cases, the appearance even in little children being most striking (see Fig 1)

In trying to arrive at an exact differential diagnosis of chronic intrapulmonic suppurations it must be remembered that as a working rule all may be regarded as "lung abscesses". A lung abscess may begin outside the lung itself, as, for example, in an empyema, and the secondary abscess may even drain itself through a bronchus. Occasionally the radiograph may show a level liquid surface-line with clear space above and opacity below (see Fig 2). But when it comes to the operation we must be prepared for surprises.

The surgeon must possess that quality of mind known as *imagination*. He must have the faculty of producing a distinct mental image showing, as it were, the physical characteristics of the object with which he has to deal. He must have in his mind a picture of the morbid part formed with the help of all the diagnostic aids at his command—and at the same time he must keep an open mind and change his preconceived idea and also his plan of action as the progress of the operation or of the disease indicates previous error.

Although bronchoscopy was practised in but two of the cases in this list, I have had the advantage of this important diagnostic aid in several other cases and shall employ it when feasible whenever a pulmonary operation is contemplated.

In addition to the possibility of finding an unsuspected foreign body some points of pathological anatomy can be cleared up with a certainty at least as great as that achieved in urological cases by cystoscopy

My attempts at cure by operation were Thoracotomy and drainage

Thoracoplasty for reducing the capacity of the affected side
Extrapleural tamponade (Tuffier)

Extirpation of the affected part of the lung

I have been surprised in some of my cases, especially those of bronchiectasis, at the tremendous toughness, thickness and rigidity of the inflammatory tissues surrounding the diseased focus. This point alone is enough to convince one of the futility of treating these cases by artificial pneumothorax and to make one doubt the efficiency in indurated bronchiectasis of Tuffier's method of extrapleural plugging, which he has so successfully employed in apical tuberculosis.

Briefly, this operation consists in the careful digital dissection of the unopened apical pleura from the endothoracic fascia through an intercostal incision, the forcing downward of the entire apex compressing the lung tissue so as to leave a great hollow where the apex was, then the implantation of living tissue, either fat or benign tumor substance, so as to fill completely the dead space, finally, the closure of the wound by suture. I would suggest as a name for this ingenious operation biotamponade—or if fat is used, lipotamponade.

In old cases of fetid bronchiectasis with the usual mixture of bacterial strains and with intimate adhesion between the visceral and parietal pleuræ, there is a very real danger of infecting the tissues surrounding the newly made extrapleural cavity even without breaking into the septic focus. This danger is obviously less when we are dealing with a pure tuberculosis.

The two-stage operation in certain forms of true lung abscess may be an advantage. At first the free pleural cavity is opened, inspected and palpated, and the extent and character of the disease ascertained. A few days later the drainage

operation may be undertaken with increased accuracy and better chances of success. The general pleural cavity can be well protected, even in the neighborhood of suppuration (see Case VIII and Case IX)

If the operation is to be performed with a view to resection of the diseased lung, however, one sitting is best

Differential pressure, however attained, is a valuable aid in chest surgery, but it must be understood that most of the commoner operations upon one lung can be done with anæsthesia managed in the ordinary way

No major work through the thoracic cavity should be undertaken without full narcosis

Anæsthesia by intratracheal insufflation has been a great comfort in many of these cases and its application tends to become simpler. Still, in spite of the beautiful, almost automatic, character of this method of anæsthesia it is far from "fool-proof," and there should be the most scrupulous attention to details. The apparatus must be tested immediately before using it. A supplementary bellows must be at hand in case the electricity fails, a woven trachea tube of proper size ($\frac{1}{3}$ to $\frac{1}{2}$ the calibre of the trachea) must be selected and inserted under the guidance of the eye. During the entire operation the air pressure and the strength of ether mixture must be carefully observed. Even when everything is running smoothly and the patient's color is good the pressure should be completely shut off for a few seconds every minute. And there are a number of other points which it is not necessary to mention here. However, the technic is not difficult to acquire and it can be well studied by experiment in the ordinary run of surgical cases in which the differential pressure element is not an essential factor

REPORTS OF CASES WITH CRITICAL REMARKS

CASE I—*Bronchiectasis* B F Exploratory thoracotomy in intratracheal anæsthesia

The history of this patient has been reported and may be found in the ANNALS OF SURGERY for July, 1910. It was the first

case in which thoracotomy in a human being had been performed with the aid of intratracheal anæsthesia. The disease had been characterized by the usual profuse expectoration and by severe attacks of pulmonary hemorrhage. The operation was an exploration which revealed the site of the tough adhesions in the right subscapular region (indurative bronchiectasis—Hoffmann). The hand within the thorax, aspiration through the sound chest wall was practised but the abscess could not be found by this means. For some reason improvement followed this insufficient operation but the patient died of a hemorrhage a few months later.

CASE II—*Bronchiectatic abscess, thoracoplasty, infection of opposite lung. Death*

I B, a boy of nineteen was referred to me on August 11, 1911, by Dr James A. Miller, from his service at Bellevue Hospital.

Eight months before his illness had begun with pain in the right chest, cough and fever. No tuberculosis.

When he came to me he was in good general condition though there was some cyanosis. His breath was very fetid and there was a daily expectoration of eight ounces, the patient often vomiting from his cough.

The pulse was normal, the temperature rising at times to 100°. Over both chests were numerous moist râles but the right base appeared to be most involved. Below the tenth rib posteriorly on the *left* side there was impaired resonance.

A radiograph by Dr. Hirsch disclosed a shadow representing the diseased area in the right chest.

Operation—On August 17, 1911, at Bellevue Hospital, the patient in ether anæsthesia, I resected two inches or more from the seventh, eighth, ninth, and tenth ribs, my incision being parallel with the border of the latissimus dorsi muscle. The pleura was not violated.

While this operation did not diminish the quantity of sputum, its character changed and became non-odorous and more mucoid. The temperatures ranged about 99° F.

In March, 1912, the patient entered Mt Sinai Hospital for further treatment because of repeated severe hemorrhages.

An X-ray picture at this time showed some clearing of the former shadow but there was opacity in the right base up to the ninth vertebra. The general condition and weight had improved.

greatly after the operation but had then deteriorated Expectoration about four ounces a day

On April 12, 1912, I removed large sections of the second, third, fourth and fifth ribs in the axillary line, the anæsthetic being ether administered by intratracheal insufflation The patient's color remained excellent during the anæsthesia, but directly afterward there was deep cyanosis continuing for some hours For about two weeks there seemed to be improvement but the left lung became acutely infected and he died on May 16 Unfortunately no autopsy

Critical Note —Another discouraging case The question comes up as to the possible influence of the intratracheal insufflation in the appearance of the acute process in the left lung, although it must be borne in mind that this lung was far from normal from the beginning Still, the second operation under the insufflation was no more severe than the first in ordinary anæsthesia Perhaps the tube was too large in spite of its careful selection That injury to the lung can occur from intratracheal insufflation is well known, though a proper sized tube and attention to details of pressure with periodic collapse of the lungs should make the accident a rare one

CASE III —*Bronchiectatic lung abscess, resection of ribs and attempted drainage* G R, thirty years old, had been sick for nine weeks with pain in the right upper chest, cough, profuse and extremely fetid expectoration, fever, vomiting, one chill, and night sweats There had been much loss of weight and three slight hæmoptyses

He was referred to me by Dr James A Miller, who stated that the case was very probably non-tuberculous, a number of sputum examinations having been negative

The blood showed 18,000 leucocytes with 90 per cent polymorphonuclears

On February 6, 1912, he was admitted to Mt Sinai Hospital

There was fetid expectoration amounting to about 200 c c in twenty-four hours Cough and expectoration occurred at once when the patient lay upon his left side There was dulness in the right posterior chest from about two finger breadths below the angle of the scapula Prolonged expiration at the upper level of the dulness with harsh breathing and coarse sonorous and sibilant râles below this point

Radiography showed an opacity in the right upper chest reaching almost to the apex of the right lung but not entirely obliterating the normal transparency at this point. The opacity was as large as an adult human palm.

Dr Miller stated that he had aspirated the suspected area and had secured a few drops of thick mucopurulent material.

On February 16, in intratracheal anaesthesia with ether, an incision was made along the border of the latissimus dorsi, beginning almost at the apex of the axilla. Sections of the third, fourth and fifth ribs were removed here and the chest opened. The pleura was free everywhere except posteriorly and the area above indicated where there were dense adhesions. The lung and parietal pleura were united by a running catgut suture, except posteriorly where the adhesions existed. A large aspirating needle was then plunged repeatedly into the indurated mass but failed to reach a pus cavity.

About six days after this operation I punctured the site of the supposed abscess a number of times through the wound. The result was persistently negative. The patient, however, continued to improve, expectoration amounting to less than 200 cubic centimetres in twenty-four hours and there was an increase of seven pounds in weight. On March 20 he was discharged from the hospital, the wound healed. His sputum then amounted to 100 cubic centimetres in the day. He was subjectively and objectively improved.

Note—There is nothing remarkable about this case unless it be the fact that as in Case I an insufficient operation was followed by unexpected improvement. I proposed further surgery to this patient but he regarded his condition as tolerable and therefore he refused.

CASE IV—Bronchiectatic abscess, thoracotomy and drainage, multiple rib resection On December 17, 1912, this patient, Harry G., twenty-three years old, was transferred from the medical service of Dr Manges at Mt Sinai Hospital. He had been ill for six months with cough and profuse foul expectoration—always more abundant in the morning. There had been eight hæmoptyses, much blood being lost each time. There were occasional slight attacks of fever.

On physical examination, there was dulness with hard breathing and inconstant "sticky" râles in the right axilla. The patient

had clubbed fingers His general condition, however, was excellent as to nutrition and musculature

The temperature was normal, the pulse 80 and the respiration rate 24

A radiograph made by Dr Jaches, on December 7, 1912, revealed a sharply defined, oblong shadow opposite the base of the heart, with a prolongation upward and outward There was also a narrow shadow passing downward and outward (see Fig 3)

Operation—On December 20, 1912, in intratracheal anæsthesia, an incision was made parallel to the fibres of the latissimus dorsi muscle in the right posterior axilla A four inch section of the fifth rib was removed and an attempt was made to enter the pleural cavity Adhesions all about, however, showed a complete walling off A section of the fourth rib was removed, also without entering the general pleural cavity, and a needle puncture withdrew a small quantity of fetid pus A narrow opening was made with the scalpel and then with dressing forceps the extremely tough and dense membrane surrounding the abscess itself was torn apart, the dressing forceps on withdrawal widening the opening into the cavity Explored with the finger there were evidently many loculi and the case one of bronchiectatic abscess But little pus escaped at this time The abscess was very deep and lay next to the anterior chest wall The entire wound was now packed with gauze and the patient sent back to bed with the intention of subjecting him to further operation at another time The anæsthesia had been excellent throughout, although some blood and pus had appeared at the patient's mouth during the operation

Ten days later the patient was anæsthetized in the usual manner with nitrous oxide and oxygen and, in the hope of reaching the bronchiectasis more directly, about two inches of the fourth rib were resected at its anterior inner portion To my surprise, upon incising the chest at this point I found that I had invaded the free pleural cavity. It was quite clear that the former operation had drained the abscess as far as was possible, so the opening in the pleura was packed and the remainder of the wound was sutured A tube was later placed in the abscess cavity and suction maintained with the apparatus referred to in Case IX The patient's condition now improved every day but he still daily

expectorated from three to five ounces, the only difference noted being that the discharge was less purulent and more mucoid than it had formerly been

The wound healed and the patient was sent to a convalescent home. His general health was good but the cough and expectoration for which he sought relief had been influenced but little.

Nearly a year after the first operation this man presented himself again, saying that he was unable to work and that the foul discharge from his lungs made him so miserable that he was willing to submit to anything rather than continue as he was.

On November 21, 1913, in ether anæsthesia by inhalation, I removed sections from the fourth, fifth, sixth, seventh, eighth and ninth ribs through a long posterior incision. The inner bone-sections were made just to the spinal side of the costal angle and the amount resected was about two and one-half inches from each rib. The pleura was not injured. The wound was closed by suture with tube drainage above and below. While hemorrhage had been free it was not near the danger line. The chest wall was thoroughly strapped so as to approximate the cut ends of the ribs and reduce the size of the thoracic cavity.

Another examination of the sputum was negative for tubercle bacilli. A culture by Dr H Plotz, of the Pathological Laboratory, showed *Bacillus mucosus capsulatus* and from this a vaccine was prepared and given. Highest dose one billion. The patient thought he noted improvement following this therapy. There was now steady progress but by no means a cure. The patient's general condition was very good and his "emptyings" occurred usually but once a day—in the morning. The discharge was not as foul as it had been and the quantity was seldom more than three and one-half ounces.

The case is not yet finished and I hope to improve his condition still further, perhaps by completing the Wilms's operation, resecting the ribs anteriorly, or possibly by attempting the extirpation of the well localized lung infection.

Because of recent published experiences and because Dr Yankauer had found and removed an unsuspected foreign body from the bronchiectatic cavity of an old man in one of the medical services at Mt Sinai, H G was bronchoscoped before his discharge from the hospital but nothing was found. The diagnosis of bronchiectasis was, however, confirmed.

A glance at the photograph (Fig 4) gives an idea of the man's general condition and also shows the degree of deformity produced by the operation. The X-ray (Fig 5) shows the collapse which was attained.

Note—I am by no means proud of this result even though it compares favorably with many of those reported in recent literature. If we ever are to accomplish anything like an actual cure in these almost hopeless cases it will be by means of direct surgical attack with the actual removal of the bronchiectatic mass.

CASE V—*Bronchiectatic abscess, transpleural drainage*. A S., a woman of twenty-six, had been well until March, 1912, when she had "pneumonia" followed by left empyema for which she had been operated upon in another hospital. She had been sent home "well" but there was a relapse and a discharging sinus persisted. At the time of her first operation she was coughing up enormous quantities of pus.

She entered Mt Sinai Hospital on April 19, 1913. The left lung was entirely dull and in its lower third flat. There were bronchial breathing and numerous râles.

There was a deep sinus in the posterior axillary line at the level of the eighth rib and when the patient coughed there was a mucopurulent discharge.

X-ray by Dr. Jachess showed in the left chest one homogeneous shadow, denser below.

On May 26, 1913, in ether intratracheal anaesthesia, I made long resections of the sixth and seventh ribs in the postaxillary region but extending far toward the back. A honeycomb cavity fully as large as a man's fist was exposed, the walls lined with sluggish granulations and showing five separate bronchial fistulae of various sizes. The tough pleura on the costal side was resected and the huge cavity was packed (see Fig 6).

The patient made rapid improvement and the wound again shrank to a sinus, which was in truth a mere bronchial fistula discharging opalescent mucus when the patient coughed. She was discharged three months after the operation.

Twelve weeks later, November 15, 1913, there was an infection of the sinus with constitutional symptoms. Under suitable dressings the bronchial fistula regained its "normal" condition.

Critical Note—This case illustrates the futility of expecting a radical cure of these bronchiectatic cavities by ordinary drainage, no matter how perfect. The walls are rigid and the bronchial openings cannot fall together nor do they granulate. I repeatedly tested the various escharotics and the actual cautery through the ample opening, but with no good effect. In another case—perhaps even later in this one—an attempt might be made to dissect out a stump of each bronchus from the wall of the cavity, crush it and ligate in the hope that granulation tissue might then form and lead to a permanent closure.

CASE VI—*Diffuse pulmonary gangrene, hæmopneumothorax, thoracotomy* Death H A, a man of forty-eight and previously healthy, was seen by me in consultation with Dr D H Davison on October 11, 1913, after two weeks of what had been diagnosed left septic pneumonia. The disease showed no tendency to clear up and the entire left chest was flat to percussion. Aspiration by the attending physician withdrew foul, sanguineous fluid which under the microscope showed no white cells but granular detritus, bacteria and blood pigment with broken down blood-cells. The heart was but little displaced. Patient icteric and septic with pulse 120 and temperature 104°. There was little cough and no foul odor from the mouth.

A few hours later, in local anæsthesia, I resected the eighth rib in the posterior axillary line, evacuating much fluid, clot and fetid gas.

Next day I was able to get a good view of the lung itself which was dry and obviously gangrenous as far as the eye could see. The pleura also was sloughing and a whistling sound within the chest indicated an opening into the lung. The wound remained dry and necrotic, delirium supervened and four days after operation death occurred. No postmortem.

Note—This case is of interest principally because of the absence of physical signs indicating pneumothorax. The entire chest in all postures was absolutely flat to percussion, yet there was much gas under pressure in the pleural cavity. The character of the aspirated fluid and especially the absence of pus cells led us to diagnose perforation of the lung before operation. I have seen the same noncellular foul sanguinolent fluid in a chest some days after a gunshot injury of the lung. Judging by the great extent of the lung necrosis this case was hopeless from the first.

It was one of those cases, rare on the operating table, in which there was gangrene without suppuration

CASE VII—*Acute abscess of the lung, thoracotomy and drainage* About seven months before admission to Mt Sinai Hospital, Harry L., forty-one years old, had been seized with a malady accompanied by a severe cough with fetid expectoration, following undue exposure to cold. There was fever and loss of weight. The amount of expectoration was as much as eight ounces in a day. There had been no night sweats.

He was transferred from the medical service of Dr Alfred Meyer on March 29, 1912, after a residence of several weeks in the hospital. During this time his temperature had rarely risen to more than 100°. Repeated examination of the sputum had failed to disclose tubercle bacilli but there were distinct evidences of pulmonary disease of the upper portion of the left chest.

An X-ray examination on February 7 showed a distinct circular shadow below the left pulmonic apex and apparently nearer the back of the chest than the front (Fig 7).

About the 22nd or 23rd of March the patient began to have high fever with alternating drops of temperature, but the sputum was still negative for tubercle bacilli and the white blood count was normal. On March 29 Dr Meyer had aspirated pus through the anterior part of the chest.

The same afternoon under ether administered by the intra-tracheal insufflation method, I made an incision beginning near the apex of the axilla and running parallel to the border of the latissimus dorsi muscle for about six inches. The serratus magnus was divided at this place. Sections of the third, fourth and fifth ribs were removed over an area the size of the palm of the hand. Careful dissection between mouse-tooth forceps showed that the pleura was intimately adherent to the lung. Aspiration of the abscess was followed by a free opening made with the dressing forceps, the general pleural cavity remaining uninvaded. On digital exploration there was thorough walling off, although from the large quantity of pus expectorated it was most probable that an opening into the bronchus existed. The abscess cavity was irrigated, then lined with a pouch of rubber dam which in turn was filled with gauze. Iodoformized gauze was packed into the external part of the wound and a few sutures were placed in its lower part. During the operation there had been a con-

siderable discharge of pus and mucus from the mouth. The patient was sent back to the ward in good condition.

Although during the next 48 hours the temperature came down, the patient was in a very uncomfortable and serious condition, owing to the gathering of large quantities of discharge in his trachea. This he seemed unable to expectorate, although on observation it appeared that he raised and swallowed the discharge. Periodically the foot of the patient's bed was elevated eighteen inches and he was turned upon his face in the hope that this might facilitate the bringing up of the pus.

Four days after the operation the patient died, evidently of a pneumonic process, probably near the site of the abscess. No autopsy was permitted.

Critical Note—Apparently a serious secondary infection with putrid abscess had begun when the temperature rose just before the operation. The patient's condition then seemed grave.

One technical error was committed—namely, the irrigation of the abscess cavity. It has been pointed out by Garré and Quincke that this procedure is particularly hazardous because of the danger that septic fluids may enter bronchi which until then have escaped or that the infection may even run over into the healthy lung. And it appears to me that even with the advantage of intratracheal anæsthesia fluid introduced in great quantity, as by irrigation, may not be blown out of the mouth quickly enough to prevent extensive septic flooding.

CASE VIII—*Acute abscess of the lung, thoracotomy and drainage*. Miss E. B., twenty-four years old, had been well until September 24, 1912, when she had an attack of what was called "la grippe". The most annoying symptom was pain in the external anterior part of the right chest at about the level of the third or fourth rib, and this point was also very tender to the touch. For four weeks the patient ran an irregular temperature, the pain and tenderness persisting.

I saw her with her physician, Dr. Manges, on October 12, in the Private Pavilion of Mt. Sinai Hospital. Aspiration had been performed a few days before when a little slightly clouded serum had been withdrawn. Subsequent aspiration was, however, negative. A Röntgen picture suggested fluid to the level of the seventh or eighth rib in the right chest (Fig. 8). The patient's condition

was wretched. There was mucopurulent, blood-tinged expectoration, cyanosis and dyspnoea.

In nitrous oxide and oxygen anæsthesia, I aspirated repeatedly in the posterior axillary region but with negative result. I then made an incision parallel to the border of the latissimus dorsi muscle and removed generous sections of the eighth and ninth ribs, opening the pleural cavity for inspection. There was no fluid and there was but one firm, dense adhesion binding the lower lobe anteriorly to the chest wall. Otherwise, although the right lung appeared to be covered with a rather thin layer of greyish membrane, there were no adhesions.

The peculiar greyish appearance of the diaphragm was so remarkable that I excised a minute piece of it under the impression that its examination might prove useful. The muscle was, however, so extremely thin that the tiny opening spread until it was fully as large as a dime. I closed this by a single mattress suture. The chest wound was now also closed, a piece of gauze being left as a packing down to the adhesion. At the end of the operation it was found that the patient had had a considerable discharge of blood from the mouth.

There was a decided improvement in the general condition following this merely exploratory procedure and the wound healed kindly without the occurrence of intrapleural suppuration. The pain in the anterior chest, however, did not disappear and cough and expectoration continued. The temperature rarely rose now to a point beyond 101° . There was considerable improvement in nutrition.

About the tenth of November a point of induration was noted just beneath the right mamma, and four days later, in nitrous oxide anæsthesia, a long incision was made in the inframammary fold and pus was encountered here outside of the chest itself. The mamma was turned up off the chest wall and the origin of the flow of pus was found in the nipple line just below the fifth rib. A section of this bone was removed and the finger could easily explore a sponge-like abscess about 30 c.c. in extent. A tube was put in as a drain and the submammary exposed space was lightly packed with gauze.

Convalescence from the operation was rapid and the patient was discharged from the hospital in a month. A few weeks

later healing was complete. The inframammary cicatrix was most unobtrusive.

Note—In the case just reported the exact diagnosis was in doubt. Referring to the radiograph (Fig 8), the straight horizontal limit of the right chest shadow strongly suggested fluid level—yet this appearance must have been caused by something else unless we can imagine that an extremely thin layer of liquid exudate could have caused it. Comparing the density of media in the two “clear” parts of the chest there is no hint of compression on the right side such as we might have expected had fluid forced the lung upward.

My first operation was truly an exploration and it accomplished the localization of the abscess and gave knowledge as to the extent of the adhesions, so that at the second step I resected rib without fear of invading the uninfected part of the pleural cavity. I have since made use of this double operation with success.

CASE IX—*Abscess of the lung complicating paratyphoid fever, thoracotomy and drainage* On December 22, 1912, N S, a man of twenty-two, was transferred from the Rockefeller Hospital to Mt Sinai Hospital with a diagnosis of empyema in the course of paratyphoid fever.

The history abstract stated that he had also been treated at the Rockefeller Hospital for what appeared to be a complicating lobar pneumonia. He had been aspirated in the seventh interspace at the right scapular line and 20 c c of thick, greenish pus had been obtained.

On examination there was dulness below the fourth rib anteriorly and beneath the level of the eighth dorsal spine posteriorly. Breath sounds over the flat area were diminished or absent. Fremitus was increased.

The white blood-cells were but 10,200, the temperature was 101°, the pulse 100 and the respiration 24.

The patient still suffered from his paratyphoid infection and was acutely ill.

On the following day he was anæsthetized with nitrous oxide and oxygen and I resected the seventh rib where it crossed the border of the latissimus dorsi muscle. Before making the incision aspiration was practised and only on very deep puncture toward the base of the chest was pus obtained. Entering the chest after the rib resection there was no fluid and there were no

adhesions, except of the right lower pulmonary lobe to the diaphragm and outer chest wall. Under the guidance of the eye an indurated place in the right lower lobe was aspirated and pus obtained. It was then determined not to evacuate the abscess at this sitting. Instead, a portion of the eighth rib was also excised so as to make the opening into the chest ample. Gauze packings were put in so as to cause the formation of adhesions between the parietal and visceral pleuræ above the abscess, with a view to evacuation at a second sitting.

Four days later the patient was again taken to the operating room and without anæsthesia the central packing, which went down to the abscess, was removed, leaving the "walling off" packing undisturbed. The opening was large enough to permit of aspiration with the aid of sight through the very thick firm-walled abscess and pus was again obtained. The scalpel was now carried down to the point where the needle entered the lung and the abscess wall, tough and almost cartilaginous in feel, was incised and the opening enlarged with dressing forceps, but the fluid was evidently not under very great tension and it was not until the patient was turned upon his side that a large quantity of extremely foul and thick pus poured out in a syrupy stream. A large sized drainage tube was carried several inches into the cavity which was irrigated and new packings were placed around that part of the tube between the thoracic wall and the actual opening of the abscess.

The culture from the laboratory was reported "streptococcus" (examined by Dr P. Aschner).

On January 8, 1913, twelve days after the evacuation of the abscess, the last of the walling-off packing was removed, much force being required to detach it from the pleural adhesions. Now local improvement set in but the constitutional symptoms were still severe, the temperature often reaching 105°. The wound was apparently divided into two parts, the first being virtually an encapsulated empyema, the actual lung abscess being entered by an opening just about large enough to fit the tube and this opening was almost a finger's length from the surface. On account of the very great rigidity of the abscess walls drainage was not easy. The patient was now transferred to a bed on the roof and a suction apparatus was improvised with the aid of a vacuum cleaner and a bottle for collecting the discharge. This

was kept going day and night and I believe contributed greatly to the comfort of the patient and to his convalescence. The wound was healed in the latter part of April and the patient was sent to a convalescent home in the country. He gained rapidly in health and strength, although his cough was slow in disappearing. In June the cicatrix broke down and discharged for a few weeks but closed spontaneously and the man has remained in excellent health ever since.

Note—In spite of the history of pneumonia and the careful examinations made by the Staff of the Rockefeller Hospital, it appears to have been impossible to make an accurate pre-operative diagnosis in this complicated case. The suspected empyema turned out to be a lower lobe abscess and though there was no sign of subphrenic suppuration before operation it may well be that an infection of this kind existed with slow boring of pus into the chest and into the adherent lung on its way toward a bronchus whence, had the patient's strength held out, evacuation through the mouth might have resulted.

Drainage by the use of the vacuum cleaner surely benefited this man—and for some days the same device with two tubes sufficed to empty the abscess of H. G. (Case IV), the one machine doing double duty. I now make use of a special suction pump devised by an instrument maker. This apparatus consists of an electric pump, a vacuum tank and a gauge for regulating the suction power. The pump acts intermittently, ceasing when the required vacuum in the tank has been secured and starting automatically when necessary to keep up the requisite exhaustion of air. The machine is quiet and requires but little attention.

A case of interest in comparison with that of N. S. is here recorded.

CASE X—A. M., thirty-five years old, a physician, was referred to me by Dr. James A. Miller, on January 8, 1913.

One year before he had been operated upon for chronic appendicitis. There had been primary union but at the end of a week he had what was called "paralysis of the bowels." He was up and about six weeks after the operation but he walked with his body bent to the right. Suddenly he coughed up a large amount of pus. Ever since then he had had attacks of coughing and raising mucopus sometimes with blood, the whole never amounting to more than four ounces in a day. Occasionally a whole

month would pass without cough When the abscess filled he had fever

A radiograph made by Dr Lewis Gregory Cole is here reproduced (Fig 10) Quoting in part from Dr Cole's report, "There is a thickening around both roots and one of the branches of the right descending bronchi There is consolidation of the lower part of the right lung obliterating the costodiaphragmatic angle, or the lung may be displaced upward by an accumulation of fluid in this region The thickening along the branch of the right descending bronchus indicates that this is the route by which this abscess cavity empties The thickening around the root on the opposite side indicates that there is a slight infection in this region There is no evidence of any other abscess in the parenchyma of the lung"

Considering the patient's condition, which was not bad, and the fact that he would go sometimes as long as a month without a discharge from the abscess and without fever, I suggested that a culture should be made from the sputum with a view to autogenous vaccine therapy A pure streptococcus strain was found at the Sondern Laboratory in June and fifteen injections were taken On October 21 the patient presented himself looking well He stated that there had been but one slight attack in four months

I believe that the prognosis in this case is favorable for a final complete obliteration and cicatrization of this suppurating cavity

CASE XI—*Abscess of left lung, upper lobe, thoracotomy and drainage* The unusual case of V H, a boy of twelve, is interesting He had been for some weeks under the observation of Dr Koplik and had entered Mt Sinai Hospital late in December, 1912 The history was one of left pneumonia in infancy, tonsils and adenoids removed in 1910 A few months prior to admission he had had a pneumonia and this was followed by chronic cough and an occasional hæmoptysis, with pain in the left chest

The boy looked pale and thin There was clubbing of the fingers Physical examination of the lungs showed, posteriorly, dulness at the left apex to a finger's breadth below the spine of the scapula Anteriorly and in the upper axilla there was dulness

The dull areas showed bronchial voice and breathing with sub-

crepitant râles over the left supraspinous region Bronchovesicular breathing over the left interscapular region

The blood count white cells, 15,000, polynuclears, 54 per cent, small lymphocytes, 27 per cent, large lymphocytes, 16 per cent, transitionals, 1 per cent, eosinophiles, 2 per cent

Neither the sputum nor the Von Pirquet test gave evidence of tuberculosis

On December 21, 1912, pus was obtained by aspirating in the left armpit, the needle pointing upward and backward

Operation—On January 2, 1913, in ether anæsthesia, an incision was made from the middle of the clavicle downward two and a half inches, dividing some of the pectoralis fibres About three-quarters of an inch of the second rib was resected, the aspirating needle forced through the thick, almost cartilaginous, tissues and the abscess opened widely with director and dressing forceps About three drachms of thick, foul pus were evacuated and tube drainage instituted

Below and to the outer side of the abscess walls normal pleura could be seen moving with respiration

For two weeks the case went smoothly and the patient improved, the cough diminishing Then came fever and pain in the wound Aspiration and digital examination failing to disclose the cause of the continued fever, cough and slight hæmoptysis, the patient, on January 24, 1913, was once more anæsthetized and, guided by a finger in the wound, a needle was passed through the posterior wall of the cavity where a few drops of thick foul pus were obtained A dressing forceps following the needle was pushed through until its blades could be felt beneath the skin just above the scapula and here a second incision was made A large drainage tube was drawn directly through the apex of the lung, from back to front Improvement went on from this time, though progress was interrupted by occasional fever Fifteen days after the last operation the tube was replaced by three strands of thick silk Ten days later the silk was withdrawn and the tract filled with Mosetig-Moorhof's iodoformized wax About three months after the first operation the boy was discharged recovered He has continued in excellent general health, does not cough and has become big and strong He has even "grown up to" his clubbed fingers, the deformity having almost disappeared (see Fig 11)

Critical Note—Surgically speaking, this was a case of lung abscess. Dr. Koplik regarded it as one of apical empyema, but whether or not the case began in the pleura the suppuration was anatomically in the lung, as shown by operation and by the expectoration of pus and by the hæmoptyses. I do not regard it as primarily bronchiectatic but as an abscess caused by pulmonary necrosis in the course of a pneumonia, bronchiectasis perhaps occurring secondarily. The extremely dense, tough wall about the pus sacs—at least two in number—is suggestive of “indurative bronchiectasis.”

CASE XII—*Fetid bronchitis mistaken for chronic abscess of the lung, extrapleural tamponade with paraffin (Tuffier)*. The patient, J. P., was a man forty-two years old. His disease began with cough, slight fever, profuse mucopurulent expectoration and night sweats with loss of weight. Sometimes he vomited after a severe coughing spell. There developed pain in the right chest and the odor of the sputum became foul. The temperature gradually rose until it reached 104° with the pulse rate varying between 96 and 120. Two weeks after the onset he entered Mt. Sinai Hospital on the medical side. This was on August 8, 1913.

The physical examination of the lungs at that time showed dulness with diminished breathing in the right axilla. Posteriorly, on the right side there was dulness from a point two fingers breadth above the angle of the scapula down to the base, with diminished vesicular breathing and diminished fremitus accompanied by noisy crepitant and subcrepitant râles.

The blood count showed 18,800 white blood-cells with 75 per cent polymorphonuclears, 24 per cent lymphocytes and 1 per cent eosinophiles.

The sputum was very abundant, pale yellowish-green and persistently negative for tubercle bacilli.

On August 15, 1913, and again on the 29th an X-ray examination was made by Dr. Jaches. The report stated that the right apex showed slight density with infiltration of the root of the lung and with bronchial nodes. At the right base there was a dense infiltration continuous with that of the right lung. The right diaphragm was high (Fig. 12).

The findings on fluoroscopy indicated the presence of fluid in the right costophrenic space. The diaphragm on that side was fixed.

The patient was kept under observation for a number of weeks, occupying a bed in the open air on the roof and in excellent hygienic surroundings. There was, however, no improvement—rather a retrogression, although the general condition remained good.

There appeared to be two kinds of sputum, the one not foul, the other extremely fetid. The amount gradually increased until on November 6, 750 c c in twenty-four hours were discharged.

Early in November, the patient was examined by Professor Tuffier of Paris, and his case was pronounced a suitable one for the operation of extrapleural compression.

Some days later bronchoscopy was performed in local anæsthesia by Dr Yankauer. At this time there was no sign of bronchial dilatation nor was there at the time of the bronchoscopy any discharge of foul pus. Dr Yankauer, therefore, concluded that probably there was a parenchymatous lung abscess communicating with a bronchus, and he believed that at the time of the examination this communication must have been plugged.

On November 7, 1913, in ether anæsthesia administered by the intratracheal method, I made an intercostal incision between the eighth and the ninth ribs through the endothoracic fascia to the pleura, which was then separated digitally from the chest wall without opening the sac itself. This peeling away of the pleura was done as Tuffier advises—very slowly and carefully. It was not a difficult procedure. The ribs of this patient, however, were very close together and I wished to avoid the long intercostal incision. In order to gain more space I resected about four inches of the eighth rib. There was finally a cavity formed which I judged to be about 400 c c in size. During this procedure there was a discharge of extremely foul pus from the patient's mouth.

Paraffin, with a melting point between 105 and 108° F, was then put in—about 300 c c in all. I began with the paraffin in the liquid state but this was unmanageable, since it did not solidify quickly enough to prevent its being expelled and, therefore, pieces of soft solid paraffin were eventually employed. The patient stood this operation well although his pulse rose to 105°. The wound was closed without drainage.

The immediate result of the operation appeared to be favorable. The patient expectorated much less than before, but on

November 10, on examining the wound there was much bulging and on separating the edges a large quantity of turbid serum escaped. The patient then gradually deteriorated and the septic manifestations became progressively worse.

On November 19 I was obliged to reopen the entire wound without anæsthesia and I removed the paraffin, packing the cavity lightly with gauze. Two days later, also without anæsthesia, I aspirated the lung hoping to find the abscess but without success. Death from his septic chest condition occurred on November 28.

An autopsy through the wound was performed by Dr. Baehr and this brought forth some interesting and suggestive disclosures.

At the site of the operation and, in fact, over the entire right base the visceral and parietal pleuræ were densely adherent. There was found not a single large collection of pus in the lung but in each lower lobe there were eight or nine small abscesses, most of them from one to two centimetres in diameter and lined by pyogenic membrane. The bronchi to both lower lobes and some to the upper showed intense congestion of the mucous membrane and in some places hemorrhage. All the bronchi were filled with thick, greyish-white purulent material. In addition to the abscesses there were some small areas of grey hepatization and small areas of gangrene, particularly in the right lower lobe. The latter as well as many of the abscesses were peribronchial in distribution. In the left lower lobe there were numerous small areas of purulent bronchopneumonia.

I will now quote from the microscopical examination.

"There is a marked thickening of the pleura from which fibrous bands run into the lungs. The walls of some of the bronchi are infiltrated with polynuclear and round-cells. Many of the small abscesses can be definitely seen to have their origin in and about a small bronchus. In addition to the presence of small purulent foci some of the portions of the lung are seen to be completely necrotic."

The bacteriology showed the presence of diplococci, probably pneumococci, some streptococci and an abundance of Gram-positive and Gram-negative bacilli.

All the time that we thought we were dealing with a bronchiectatic abscess or some other form of lung abscess the disease was in reality a presumably incurable septic fetid bronchitis with its sequelæ of suppuration and necrosis in the lung itself. And this particular error is one which has often been made (Garré and Quincke).

The case just reported was one in which there was a complete agreement in the diagnosis among all those who saw the patient clinically. He was supposed to be suffering from "bronchiectatic abscess of the right lower lobe." Yet the bronchoscopy changed all this, for no bronchiectasis was discovered. The case then, in view of the two kinds of sputum, began to look like one of extrabronchial abscess and, indeed, the post-mortem findings showed this in measure to be true, though there was no actual fistulous connection between one large abscess and a bronchus. The infection of the operative field is also hardly to be wondered at, remembering the close adhesion of the septic lung with the parietal pleura.

The misreading of the X-ray plates is an old story, and nowhere can one be misled more easily than in the diagnosis of intrathoracic conditions.

In a recent case which was in the service of a medical colleague signs pointed to a subdiaphragmatic abscess with lung fistula and the radiograph showed a high right midriff dome. The patient had expectorated eight ounces of foul pus in one gush. His condition was critical. Tenderness and a mass in the right upper abdominal quadrant led me to incise here and I quickly emptied a gangrenous gall-bladder. Still the X-ray would not permit the idea of subphrenic disease to be put aside. At a careful post-mortem examination there was no subphrenic abscess, no liver abscess, no lung abscess! I have, indeed, come to the conclusion that a high diaphragm often signifies a relaxation or paralysis of this muscle in nature's effort to reduce pressure upon inflamed organs, and that its existence is by no means pathognomonic of an exudate beneath.

CASE XIII—*Suppurative bronchiectasis, removal of right lower pulmonary lobe.* Francis W., at two and three-fourths years of age, had fallen while he was holding some partially masticated nut in his mouth and, in the gasp which followed or accompanied his fall, some of the foreign material was aspirated into the lungs. There developed cough of a spasmodic nature, with the expectoration of much purulent mucus.

With the aid of the bronchoscope, Dr Yankauer had succeeded in removing much of the foreign matter and was finally unable to discover anything more within the visible part of the lung. Bronchoscopy was performed six or seven times during the following year. Still the cough and expectoration continued and now fever and rapid pulse were also observed, the temperature reaching as high as 105° and fluctuating at this high level for several days at a time with remissions between.

An X-ray picture by Dr Jaches showed opacity at the right base which extended up to the eighth rib (Fig 13).

The child now entered the surgical department of Mt Sinai Hospital. He was well nourished but pale and apathetic. There was very marked clubbing of the fingers and toes (Fig 1). The usual signs of consolidation were found at the right base. The spasms of coughing with the ejection of large quantities of foul mucopus were most painful to watch.

Three times after admission to the Hospital he was bronchoscoped by Dr Yankauer, and after each bronchoscopy with the clearing out of the cavity there was a remission in temperature. Judging by the amount of discharge at each emptying I had some hope that a Tuffier extrapleural tamponade might tend to improve the drainage in this case and, therefore, on January 23, 1914, in ether anæsthesia by the intrapharyngeal method managed by Dr Branower, I made a long incision between the eighth and ninth ribs down to, but not through, the pleura. In order to get more room without making too long an incision I resected a part of the ninth rib and by digital separation I made a cavity about 40 c.c. in size. Into this I placed three pieces of fat from the abdominal wall of another patient and closed the wound without drainage. No improvement followed this procedure, the coughing spells and expectoration remaining about the same. For a few days the temperature remained in the neighborhood of 100° and then there was a sharp rise to 104° with corresponding constitutional symptoms. The wound was slightly infected and slow in healing.

A month later, February 27, 1914, a minute sinus remained. The child's condition, however, was such that something radical had to be done.

Another bronchoscopy by Dr Yankauer enabled him to see

all the bronchial openings but the picture was practically unchanged. Dr. Branower again managing intrapharyngeal ether anesthesia, I made a long incision above the eighth rib into the pleural cavity, spreading the ribs wide with retractors. The exposure was perfect. The two upper pulmonary lobes were apparently normal, of the usual yellowish-pink color of a child's lungs. The lower lobe, however, was liver color and of a firm consistency. The piece of implanted fat was in position and apparently alive. There were dense adhesions of the lower lobe to the diaphragm and to the lateral costal pleura. All adhesions were quickly and rather roughly freed with the finger so that it was possible to place a strong double ligature of chromicized catgut completely around the hilum of the lower lobe after having crushed the part with a powerful clamp. The lobe was then cut away. A slight oozing from the stump led me to transfix once more and to ligate again double. The stump was then carbolyzed, salt solution was placed within the thoracic cavity, a piece of gauze was laid against the raw surface of the stump and led out of the posterior angle of the wound and another little piece of gauze was placed in the original sinus. The ribs were then approximated with chromicized catgut by the pericostal method. A continuous suture of fine chromicized gut was used to hold the intercostal structures together and the cutaneous incision was sutured with fine silk. At the end of the operation the patient's pulse was about 150 but of good quality. The color which had been slightly cyanotic during the greater part of the operation became normal. Reaction was prompt and in less than an hour after the operation the boy was wide awake and crying. The hemorrhage had not been severe, most of it coming from the peeling away of the adhesions.

A careful examination of the lobe which had been removed showed that all the bronchi were dilated and turned into what might be called abscess cavities. There was no trace of a foreign body.

The first twenty-four hours after the operation the temperature did not rise higher than 101°. The patient's condition was good, pulse about 140, very little cough, no expectoration. Then there was a rise to 103° the pulse reaching the alarming rate of 200. The wound was at once dressed, a little superficial sup-

puration found and all skin sutures removed. The gauze at the posterior angle of the wound was loosened and there was a discharge of turbid fluid, probably a mixture of salt solution and pus. A tube was slipped in alongside the gauze and full stimulation was ordered. The hæmoglobin a few days after operation was, to my surprise, 75 per cent though the little patient looked very anæmic. Very gradually there was improvement, for two weeks, the child being in a serious condition, the pulse causing especial anxiety on account of its great rapidity.

About a week after the operation mechanical suction apparatus was fitted to the tube within the wound and this avoided frequent change of dressing. The patient's appetite remained good throughout.

On March 16, the slough representing the stump of the lung came away.

After this there was steady improvement and the patient, at the present writing, six weeks after the lung resection, is in a satisfactory state of convalescence. A very small opening in the chest is still present but the outlook is most favorable.¹

Note—This case demonstrates that bronchiectasis originally caused by foreign body aspiration may persist in an apparently incurable state after the removal of the exciting cause.

The amount of fat put in at the time of the Tuffier's lipotamponade, in view of the later findings, was absurdly small. But judging by the appearance and size of the bronchiectasis as seen after the resection I doubt that enough fat could have been transplanted to cure the patient.

The cause of the tachycardia is somewhat obscure. Whether it was a septic phenomenon or whether, perhaps, it had to do with the changed pulmonary circulation it would be hard to say. Dr Koplik, who saw the case in consultation, advised us to give digitalis and under this drug the pulse rate was certainly favorably influenced.

CASE XIV (Unfinished) —*Bronchiectasis, thoracotomy and drainage*. Louis G., thirty-three years old, was admitted to Mt Sinai Hospital on February 26, 1914. He had been a patient of Dr Mannheimer.

Four years before he had had pneumonia followed by empyema for which he had been operated upon. For three years

¹ At the time of proof-reading, May 10, 1914, the boy is perfectly well.

he remained well then began to cough and expectorate large quantities of mucopurulent material. There were occasional marked hæmoptyses. The daily amount of expectoration was eight ounces. The patient was altogether miserable and unable to work. He had lost weight and strength.

On admission, a cicatrix representing the former operation was seen in the posterior axillary line over the ninth rib which apparently had been resected. The general condition of the patient was good. The lungs anteriorly were negative and the right lung was also negative posteriorly. On the left there were signs representing consolidation from the left scapula to the base. There was clubbing of the fingers.

An X-ray picture showed an infiltration of the left base with what seemed to be a pulling of the cardiac apex to the left by adhesions.

About March 5 the patient was bronchoscoped by Dr Yankauer. This bronchoscopy was rather unsatisfactory, owing to the extremely poor anæsthesia and the rigidity of the patient's neck which made it difficult to introduce the instrument. Dr Yankauer failed to demonstrate a bronchiectasis but thought that he saw granulation tissue in the bronchial walls.

On March 11, 1914, in intratracheal ether anæsthesia, I incised one space above the old cicatrix and to my chagrin passed through the diaphragm and into the abdomen. The peritoneal opening was at once sutured and the chest entered in the seventh interspace with wide resection of the seventh and eighth ribs. There was a mass of pleuritic adhesions, the lung also being adherent to the chest wall so that twice it was injured and had to be sutured. A needle puncture now permitted the aspiration of a few drops of foul, thick pus and in the posterior part of the wound near the angle of the rib I opened into the now empty bronchiectatic sponge. The cavity, about 50 c c in bulk, was packed with gauze and part of the cutaneous wound closed with drainage. Considerable distress followed the operation, with cough, temperature 103° and bloody expectoration.

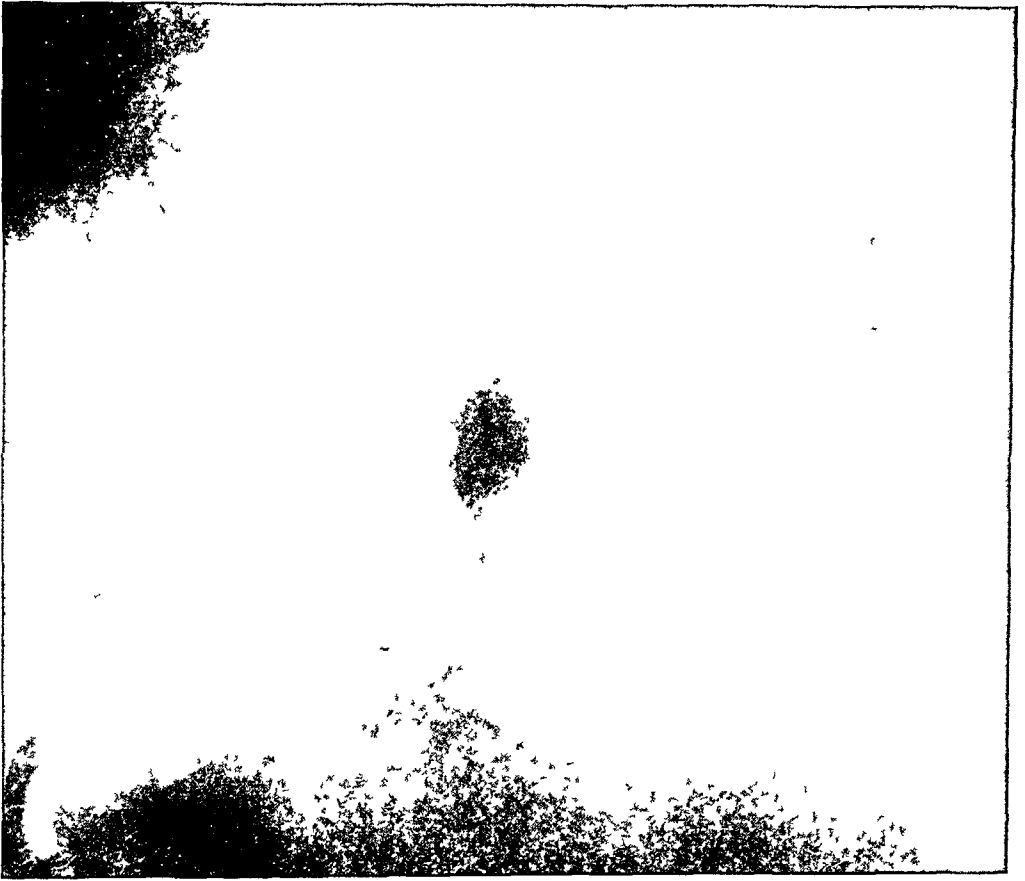
To-day, April 10, the patient's condition is improved and the wound is healing rapidly. He still expectorates from one to two ounces daily and his complete cure without further operation is doubtful.

TABLE OF OPERATIVE CASES RECORDED *

Case No	Name	Age	Sex	Date	Disease	Type of operation	Anæsthesia	Post-operative days in hospital	Immediate result			Remarks
									Cured	Improved	Died	
1	B F	55	M	Feb 21, 1910	Bronchiectasis	Exploration	Insufflation ether	27		I		Died one year later of pulmonary hemorrhage
2	I B	19	M	Aug 17, 1911	Bronchiectasis	Thoracoplasty	Inhalation ether	42		I		Infection of the other lung
2	I B	20	M	Apr 12, 1912	Bronchiectasis	Thoracoplasty	Insufflation ether	34		I		
3	G R	30	M	Feb 16, 1912	Bronchiectasis	Thoracoplasty	Insufflation ether	32		I		Opening into bronchiectasis closed spontaneously
4	H G	23	M	Dec 20, 1912	Bronchiectasis	Thoracoplasty and drainage	Insufflation ether	60		I		Improvement but condition still unsatisfactory, 3 to 4 ounces of sputum per day
4	H G	24	M	Nov 21, 1913	Bronchiectasis	Large thoracoplasty (posterior)	Inhalation ether	90?		I		
5	A S	26	F	May 26, 1913	Bronchiectasis with fistula	Free drainage by rib resection	Insufflation ether	90		I		
7	H L	41	M	Mar 29, 1912	Acute abscess	Thoracoplasty and drainage	Insufflation ether	4			I	
8	E B	24	F	Oct 12, 1912	Acute abscess	Exploratory thoracotomy	G _{as} and oxygen by inhalation					Patient remains well to date
8	E B			Nov 14, 1912	Acute abscess	Second stage thoracotomy and drainage	Nitrous oxide inhalation	63	I			
9	N S	22	M	Dec 23, 1912	Acute abscess	Thoracotomy and drainage	Nitrous oxide and oxygen	120	I			Patient well to date
6	H A	48	M	Oct 11, 1913	Pulmonary gangrene	Thoracotomy and drainage	Local	4			I	Hopeless from the beginning
11	V H	12	M	Jan 2, 1913	Chronic abscess of apex	Thoracotomy and drainage	Ether inhalation	88	I			Through drainage sputum to front of chest
12	J P	42	M	Nov 7, 1913	Fetid bronchitis	Extrapleural tamponade (Tuftier)	Insufflation ether	21			I	Chest mistaken for bronchiectasis

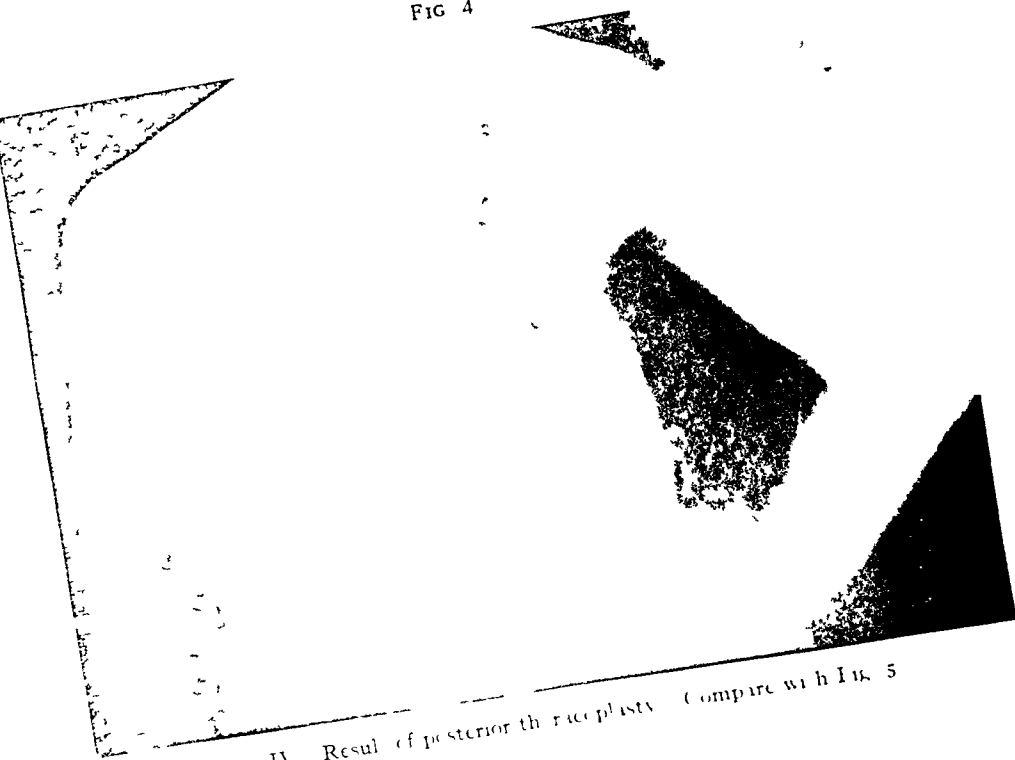
* CASE XIII, unfinished at time article was read, is now complete and adds one more cure. See history in body of text

FIG 3



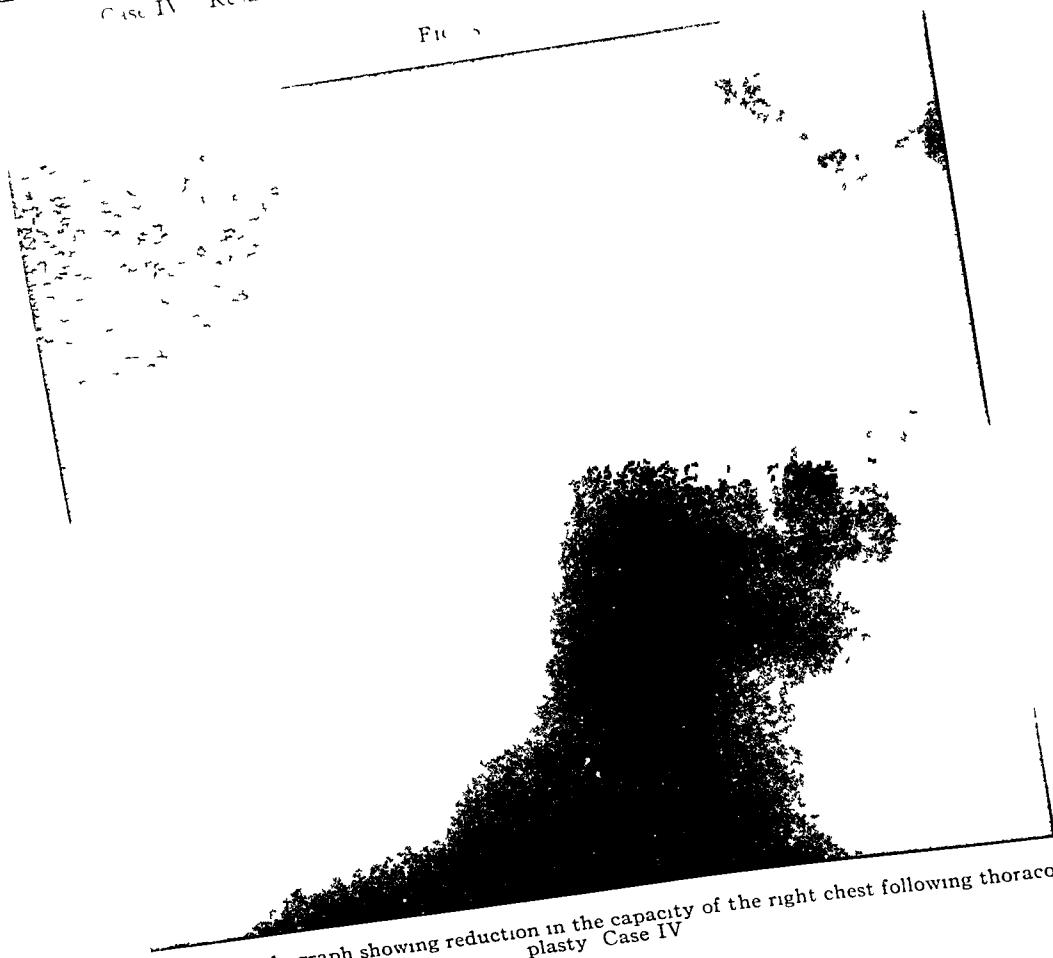
Anterior radiograph demonstrating extent of bronchiectatic mass Compare with Fig 5

FIG 4



Case IV Result of posterior thoracoplasty Compare with Fig. 5

FIG 5



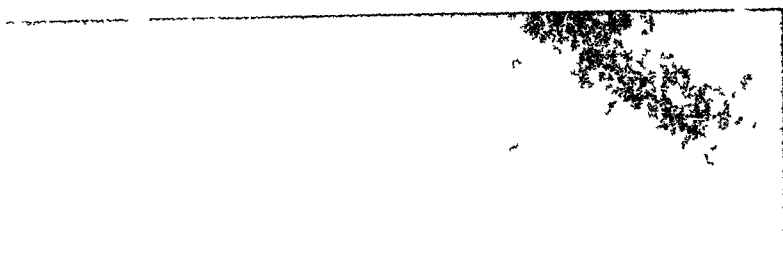
Posterior radiograph showing reduction in the capacity of the right chest following thoracoplasty Case IV

FIG 6



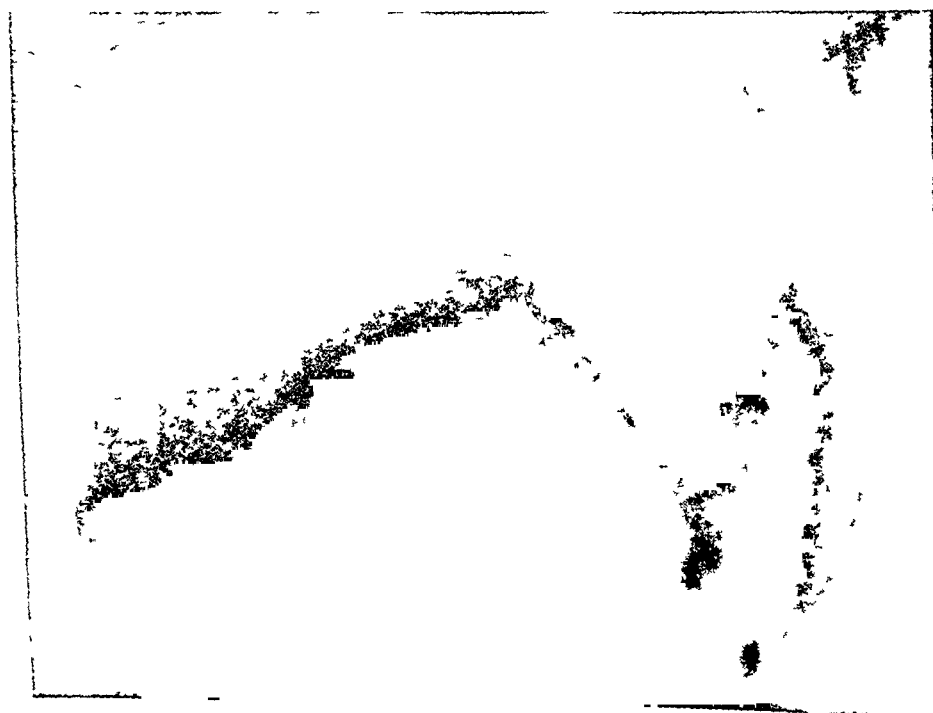
Drawing from sketch Case V Note the size of the wound and the five bronchial openings
Even this thorough drainage did not result in cure

FIG 7



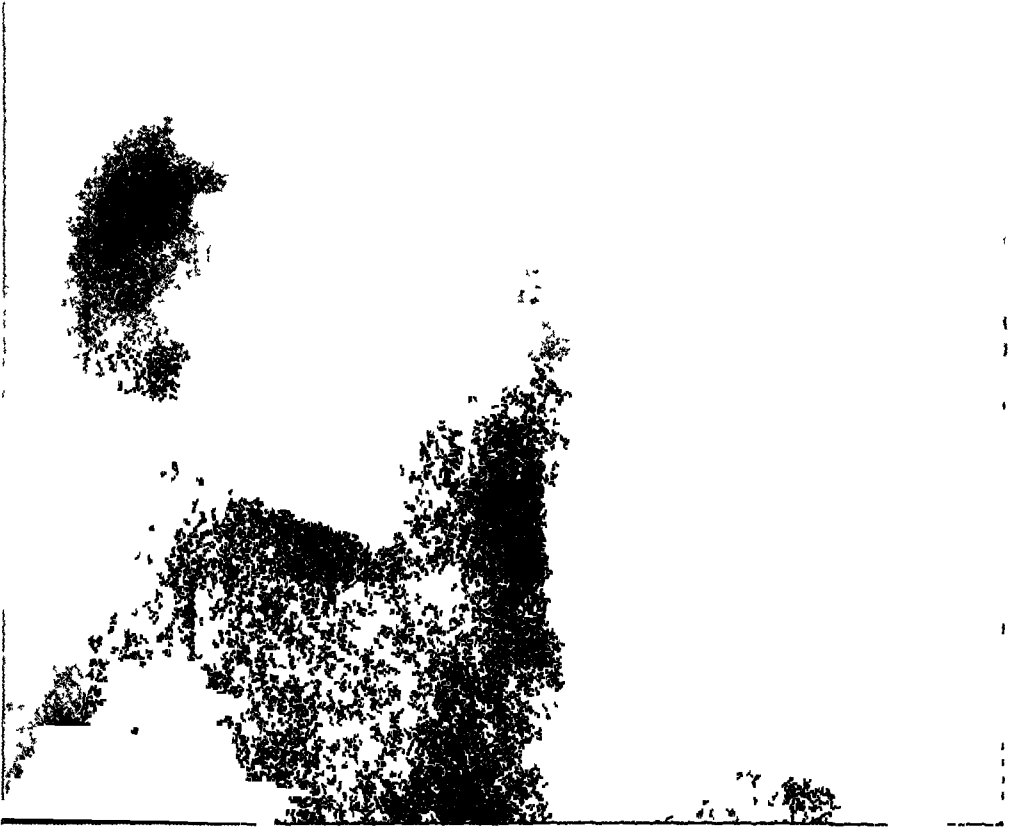
Posterior oblique - Putrid abscess of left upper lobe - Case VII

FIG 8

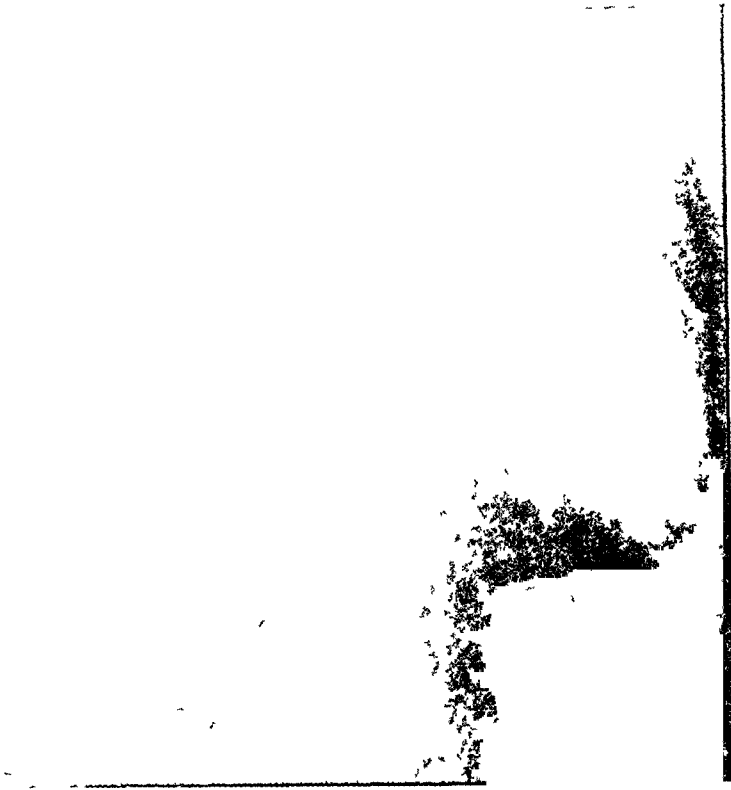


Acute lung abscess - Note pseudoliquid level - There was no free fluid in this chest
Case VIII - Miss E. B.

FIG 9



Case IX Large putrid abscess right lower lobe Probably from a subdiaphragmatic source



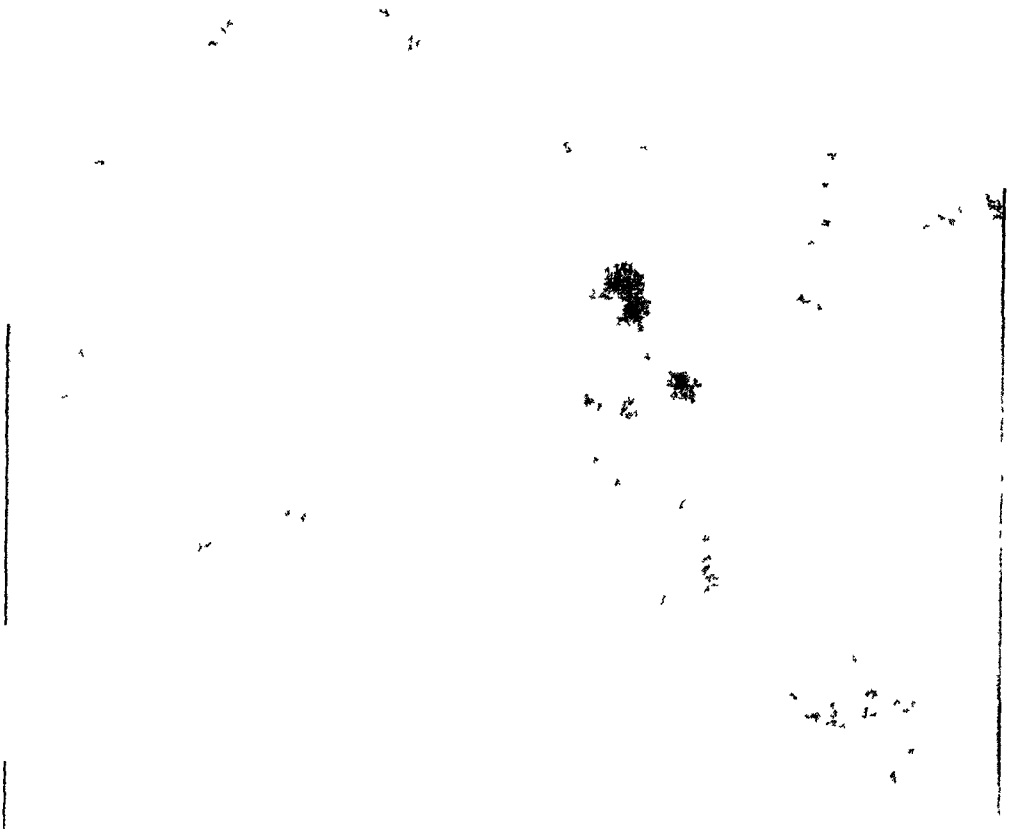
Case X. Shadow opacity in right chest probably indicating course of subdiaphragmatic abscess to a bronchus

Fig. 11



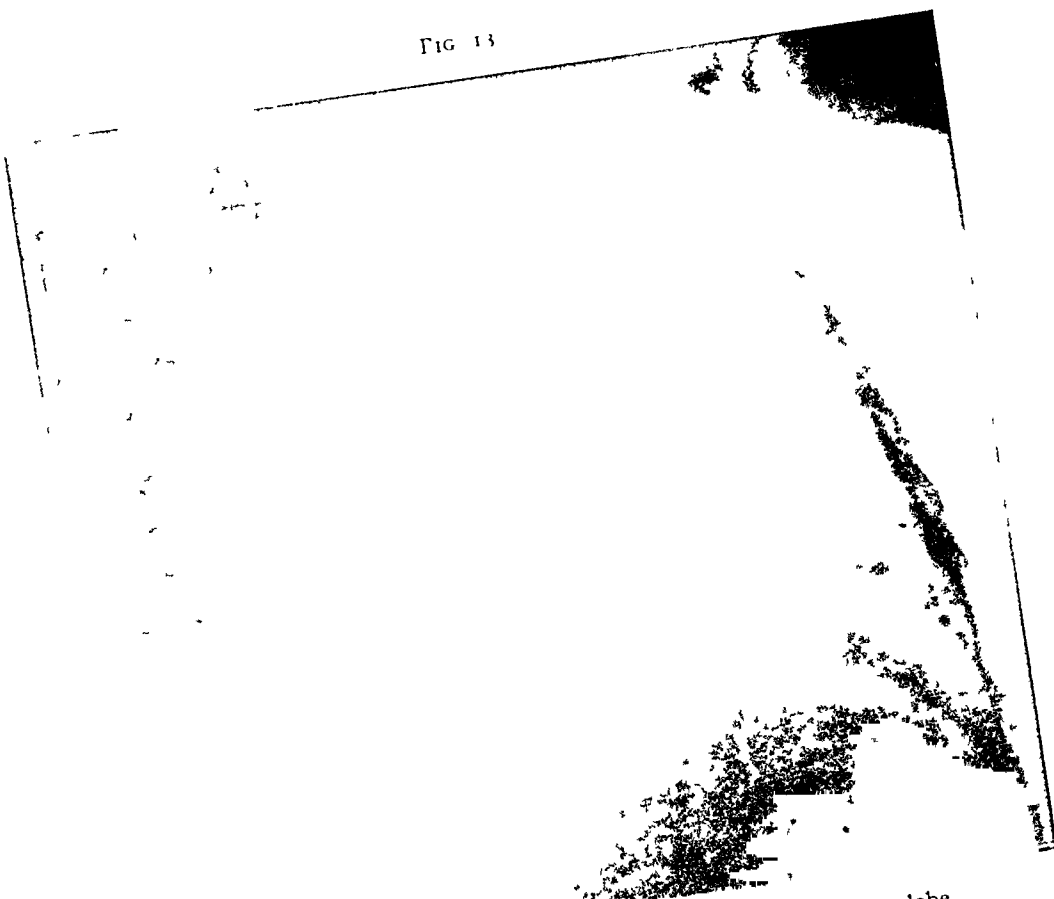
Photograph showing patient recovered after drainage of apical abscess. Clubbing of the fingers no longer present

FIG 12



Case XII Fetid bronchitis mistaken for right lower lobe bronchiectasis

FIG 13



Case XIII Case of bronchiectatic infection of entire right lower lobe

CONCLUSIONS BASED ON OBSERVATIONS IN THE CASES
RECORDED

- 1 The differential diagnosis of true lung abscess and suppurative bronchiectasis is important
- 2 Radiographic study of each case is essential
- 3 Bronchoscopic examination is a valuable procedure, and should not be omitted
- 4 Drainage of a lung abscess by thoracotomy is likely to result in cure.
- 5 Drainage of large infected bronchiectases may be followed by improvement, but complete recovery is unlikely
- 6 Extensive thoracoplasty should be reserved for those cases in which other operations have failed
- 7 Exploration of the pleural cavity and of the lungs by intercostal thoracotomy is feasible and reasonably safe
- 8 Extirpation of a bronchiectasis by removal of the affected portion of lung may lead to complete recovery The danger of the operation is great
- 9 Artificial pneumothorax and Tuffier's extrapleural tamponade should be reserved for cases of pure tuberculosis
- 10 Intratracheal insufflation is a simple, accurate and safe method of securing differential pressure
- 11 Operations involving one lung can be performed with inhalation anæsthesia

VISCERAL PLEURECTOMY FOR CHRONIC EMPYEMA.

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CHRONIC empyema is a condition which is quite common in spite of the fact that it results, in most instances, from the failure of early diagnosis and the establishment of sufficient drainage in the acute stage. In the acute stage, if free drainage is established early and the adhesions broken up at the time of the first drainage, the lung re-expands quickly, thus obliterating the abscessed cavity, and the patient goes on to rapid recovery. In the neglected case in which the infected fluid remains in the pleural cavity for a considerable length of time, the pleura becomes so thick and fibrous that even after free drainage is established, the lung cannot re-expand. In nearly all cases, this is because of the adhesions and the thickened pleura, and not due to any extensive disease of the lung. It is true that in some cases there is an abscess in the lung which drains spontaneously into the pleural cavity, but this does not seem to be the usual way in which an empyema takes place.

In the chronic cases of empyema the ribs prevent the chest wall from dropping in and the adhesions and the thickness of the pleura prevent the lung from re-expanding. The result is a large cavity which continues to discharge varying amounts of pus. Nature cannot obliterate this cavity, as she ordinarily obliterates cavities by collapse of the tissues about it. Neither can she force granulations through the fibrous wall of the abscess.

Various methods have been devised by surgeons to obliterate

* Read before the American Surgical Association, April 10, 1914

ate this cavity Estlander¹ resected the ribs subperiosteally over the entire area. The number of ribs resected varies with the size of the cavity. It is important to be radical and to resect one rib too many rather than one too few in order that no dead space remains in the upper or lower part of the cavity to continue suppuration. Many surgeons have modified this operation, for example, Saubouttin,² Beck,³ Quenu,⁴ and Tietze⁵ resected small portions of the ribs through parallel and vertical incisions of the region involved. Jaboulay and Leymarie⁶ divided the sternal attachment of the ribs, making use of the articulation at the vertebral column to mobilize the chest-wall, while Boiffin⁷ recommends resection of the ribs close to the vertebral column, making use, as it were, of the mobility of the costal cartilages. More recently, Wilms⁸ has combined these two operations and resects a couple of inches of several ribs along the spine and also along the sternum in order to mobilize the chest-wall. Schede⁹ noticed that some empyema cavities did not heal even after extensive resections of ribs. He observed that the thickened pleuræ did not unite with each other but directly impeded recovery. Consequently, he devised the operation which bears his name. This consists of removing not only the ribs covering the empyema cavity, but also the thickened parietal pleura and the intercostal muscles, so that the skin and superficial muscles rest directly against the thickened visceral pleura. This operation is usually performed through a U-shaped incision beginning along the external margin of the pectoralis major muscle to the lower part of the thorax and then backward and upward to the median line of the scapula. The skin, superficial muscles and scapula are then reflected upward, while the pleura, ribs and deeper muscles are removed over the entire cavity. The operation is severe and the shock to the patient is often alarming if not fatal, especially since many of these patients are in an extremely debilitated condition.

In 1893, Fowler,¹⁰ operating on a woman thirty-five years of age who had had an empyema with a fistula for ten years, dissected out the scar tissue surrounding the fistulous tract and removed the entire mass of

fibrous tissue from the diaphragm and lung. He was surprised to discover that the lung began to re-expand as soon as this thick scar tissue was peeled from it. The patient recovered from the operation and the wound entirely healed within a few weeks. The case was reported in December, 1893. In commenting on the case, Fowler stated that the history suggested a method of dealing with some of the cases of old empyema with a persistent sinus which resists all the means usually employed for their cure.

DeLorme,¹¹ after observing autopsy cases of old empyema, decided that the lung would re-expand if the thickened pleura was removed from it. Consequently he devised the same operation and reported it about three months later, in the early part of 1894. Unfortunately, his patient died from hemorrhage and shock.

These two men performed the same operation and arrived at the same conclusions concerning these cases, the difference being that one of them performed the operation, following out the steps as he proceeded, while the other studied out the operation in advance and then performed it. Ransohoff,¹² following the work of Fowler and DeLorme and appreciating the difficulty of removing the thickened pleura in some cases, advised making multiple incisions at right angles to each other about a quarter of an inch apart, through the thickened pleura down to the lung, so that the entire visceral pleura should be gridironed. This is a valuable procedure and may often be used with good results in conjunction with visceral pleurectomy.

We believe that the operations of Fowler and DeLorme have not received the attention from American surgeons which they deserve. We have been able to find but twenty-four cases reported in the literature by three operators in the twenty years that have elapsed since the reports of Fowler and DeLorme. The efforts of surgeons up to the time of their reports had evidently been directed entirely to obliterating the cavity in chronic empyema by collapsing the chest-wall. They apparently had not appreciated the fact that in most instances the lung itself was not badly diseased and that it would re-expand to a greater or less extent if given an opportunity. Even to-day the possibility of restoring a portion or even an entire lung to the patient is not fully appreciated. In this age of conserva-

tion it certainly seems worth while to attempt it even if we do not always succeed in restoring to the patient the use of a portion of such a valuable organ as the lung

Keen's Surgery¹³ states that, as a rule, satisfactory results cannot be expected by this method if the operation is undertaken after four or five months have elapsed since the primary drainage. Von Bergmann's Surgery¹⁴ tells us to try decortication of the lung when other methods fail. If it is possible for the lung to re-expand in a reasonable proportion of the cases without involving more danger to the patient than by other methods, we accomplish everything that is accomplished by the other methods and, in addition, restore to the individual the use of a lung or portion of a lung. This factor certainly seems important enough to be considered seriously. In previous years the results from the Estlander and Schede operations were so discouraging that, through a process of evolution, we have gradually taken up the operation of visceral pleurectomy in conjunction with these other procedures.

We wish to report two cases in which this thickened pleura was removed from an entire lung in an adult, in both cases more than six months after a primary drainage.

CASE I (No. A31028) —Male, aged twenty years. Date of operation November, 1911. Patient had had typhoid fever. Sick for three months following the typhoid when an empyema was discovered on the right side and drained. This was in January, 1908. This had been draining at intervals until he first came under observation. Examination revealed a nearly collapsed lung on the right side, with an enormous cavity which extended from the diaphragm to the clavicle. Through an opening large enough to explore the cavity, the thick, fibrous pleura over the entire lung was removed. There were a number of fibrous bands which entered into the tissue of the lung and others that bound it to the diaphragm. These were freed as well as possible. The case was considered very unfavorable after the operation was finished. To our surprise, the lung soon filled the entire thoracic cavity and drainage was entirely stopped by January 5, 1912, fifty-one days after the operation. There were good breath-sounds over the

entire right thorax, the patient steadily gained in health and strength and has remained entirely well to the present time

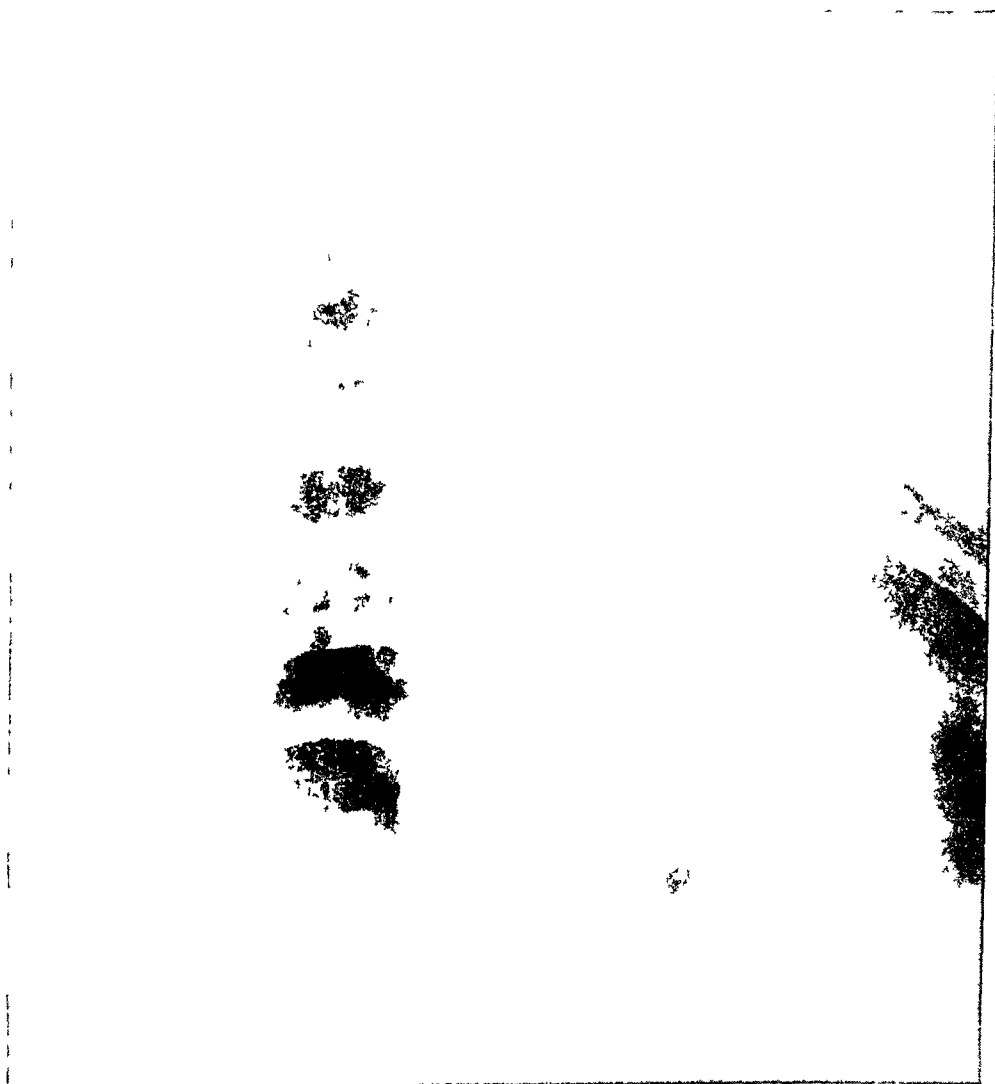
CASE II (No A77103) —Male, aged twenty-three years Examined December 7, 1912 Was shot with a rifle through the left chest in October, 1912 Bullet entered from in front, passed entirely through the thorax and was found lodged under the skin of the back Three weeks later an empyema was drained When examined the left thorax was shrunk, the patient very weak and emaciated and the entire left lung collapsed He was advised to return to his physician to get in better condition to undergo a pleurectomy

Six months following the primary drainage, in May, 1913, he returned for operation A complete visceral pleurectomy of the left lung was made The thickened pleura was removed from the lung, diaphragm and pericardium as well as possible There was very little bleeding and, although the patient was emaciated and weak, there was almost no shock following operation Drainage ceased entirely in three months There were good breath-sounds over the entire thorax and he had gained nineteen pounds in weight Two months later the patient returned with a small collection of pus in the pleural cavity under the left axilla This was drained He still has a small cavity at this point which will require further operation but at least two-thirds of the lung is functioning

These two cases illustrate the possibility of a collapsed lung re-expanding even after many months We do not intend to say that such results can be accomplished in every case of chronic empyema, and we realize that pleurectomy must be combined with resections of rib and the Ransohoff technic in most instances We wish to emphasize the fact that in our experience pleurectomy has not produced anywhere near the same degree of shock that the Schede operation does We believe that in most instances it should be attempted before extensive resections of rib are undertaken If the lung only partially expands, resections can be done at a second operation without any loss except the time of the patient

Tuffier¹⁵ recommends that with the patient in poor condition the operation be divided into several stages, rather than

FIG 1

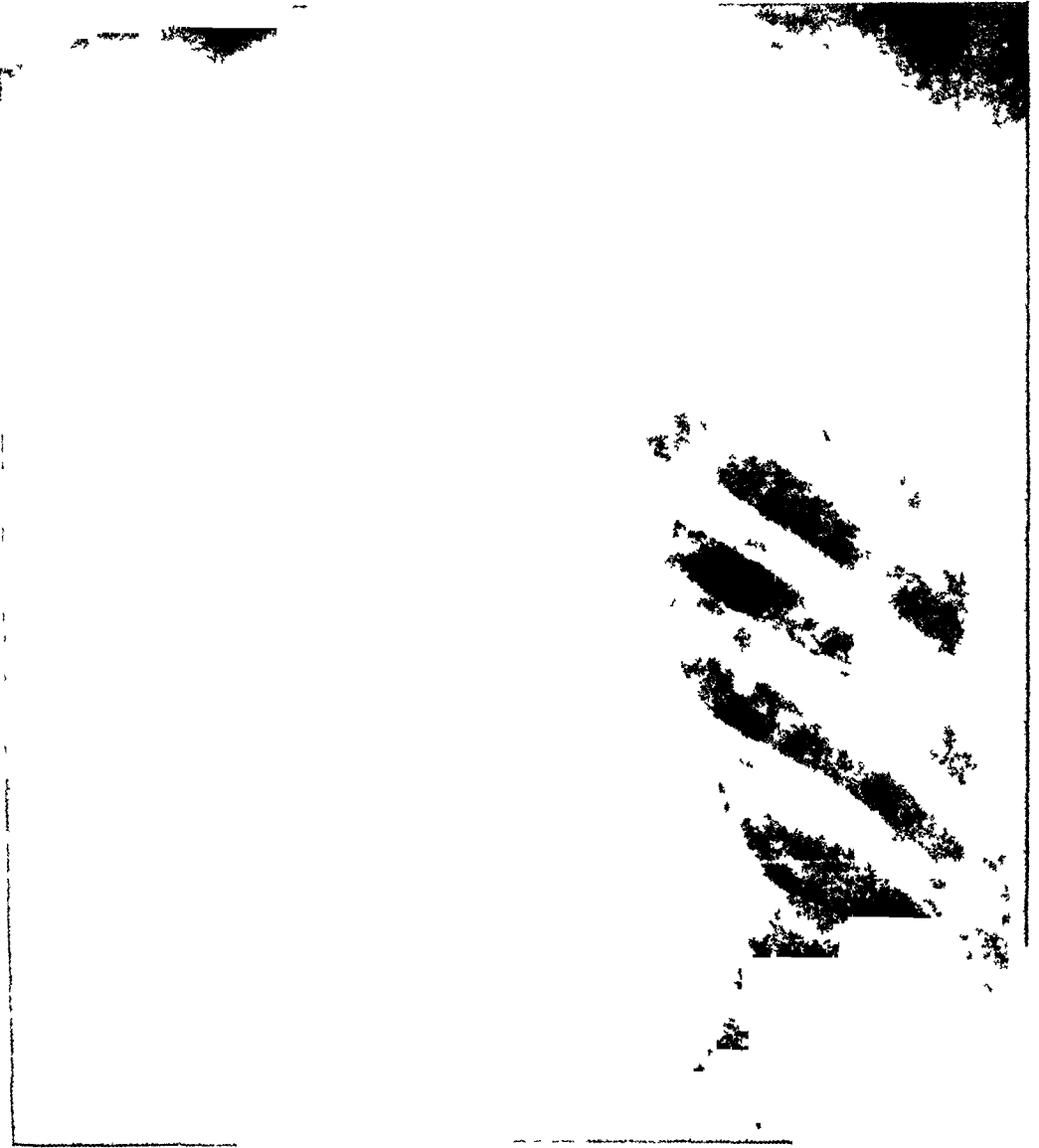


Before operation

FIG 2



Before operation



Some weeks after operation, showing re-expansion of major part of the lung

attempting to complete it in one stage. He also recommends the DeLorme operation in selected cases. We also believe that many of these cases should be operated upon in stages, and pleurectomy can be attempted. If this does not obliterate the entire cavity, one usually gains some lung expansion and the remainder of the cavity can be obliterated later by the Estlander or Schede operation.

We wish to report two other cases in which the wound healed primarily following pleurectomy.

CASE III (No. A71074).—Male, aged twenty-two years. Patient with a left sided empyema following pneumonia, which had drained at intervals for thirteen months. A cavity six inches in diameter posterior to the pericardium was explored and the thick membrane covering the pleura and diaphragm removed. The cavity healed entirely in thirty-nine days.

CASE IV (No. A73419) —Male, aged eighteen years. Patient had a left sided empyema which had drained for over two years. At operation, a cavity the size of a large grape-fruit was found external to the pericardium. The thick membrane was peeled from the lung and partly from the pericardium. The cavity closed in three weeks.

In discussing the treatment of such cases, a word should be said in regard to the preparation of the patients for operation. Many of these patients are as much in need of pre-operative preparatory treatment as patients about to undergo an operation for prostatectomy.

It is very important that the drainage should be at the most dependent part of the cavity. We have seen several patients gain from fifteen to twenty-five pounds in a few weeks with a corresponding gain in strength by changing the point of drainage to the most dependent part of the cavity. Autogenous vaccines should also be employed. After the patient has stopped gaining, following such an operation for drainage, and is in the best condition possible, irrigation of the cavity twice daily with a weak iodine solution helps reduce the infection to a minimum. In regard to the operation itself, sufficient

exposure must be obtained to make every portion of the cavity freely accessible. The entire cavity should be cleansed as thoroughly as possible and then swabbed with strong tincture of iodine before pleurectomy is begun. The incision through the thickened pleura is best started posteriorly along the vertebræ, as there is less danger, especially on the left side, of entering the pericardium. One need not fear slitting entirely through the thick pleura down to the healthy lung, as the bleeding does not seem to be excessive, and, although the lung has been injured enough to allow air bubbles to escape, in almost every instance no harm has arisen from such injury and apparently no extensive infection to the lung by such exposure has occurred. Pneumonia has not occurred in any of the seven cases in which pleurectomy has been performed. Abundant drainage to the furthest points of the cavity should be provided for by small gutta-percha drains to prevent reaccumulation of the fluid in the pleura. One operative death has occurred in this series. With our present knowledge we believe that too extensive an operation was attempted on this case. Now we divide the operation into stages when necessary.

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- ⁹ Schede. Keen's Surgery, vol III, p 553
- ¹⁰ Fowler. Med Rec, December 30, 1893, pp 838-839
- ¹¹ DeLorme. Seventh Congres de Chir, 1893, Paris
- ¹² Ransohoff. ANNALS OF SURGERY, xliii, 1906, pp 502-511
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- ¹⁴ von Bergmann's Surgery
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THE PLEURAL AND PULMONARY COMPLICATIONS OF TROPICAL ABSCESS OF THE LIVER

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A DESCRIPTION of the anatomic relations of the liver to the diaphragm and to the structures in contact with the upper surface of the diaphragm will make the study of the paths of direct extension of infection much easier to understand

Most of the upper or convex surface of the liver is in contact with the diaphragm. Over the greater part of this area of contact the peritoneal cavity intervenes, potentially at least, each opposing structure being covered by its own layer of peritoneum. Over the rest of the area the liver and diaphragm are in actual structural contact, being separated by a layer of connective tissue only. *The area uncovered by peritoneum* is bounded in front by the attachments of the anterior layer of the right and left coronary ligaments and by their junction with the falciform ligament, behind by the posterior layer of the right and left coronary ligaments, and their reflection on to the posterior borders of the lobes of the liver and the anterior surface of the vena cava. Figure 1 representing the upper surface of a liver shows this area darkly shaded. The vena cava inferior grooves the liver at the middle of its posterior edge. It will be seen that at least four-fifths of this area lies in the right lobe of the liver. If a number of livers are examined in the dissecting room, it will be found in most cases that the highest point of the convex surface of the right lobe occupies a portion of the organ in front of this area, but that occasionally a liver is met with where the uncovered area represents the highest point and occupies the dome of the diaphragm. A study of the under surface of the diaphragm shows a replica of the upper surface of the liver.

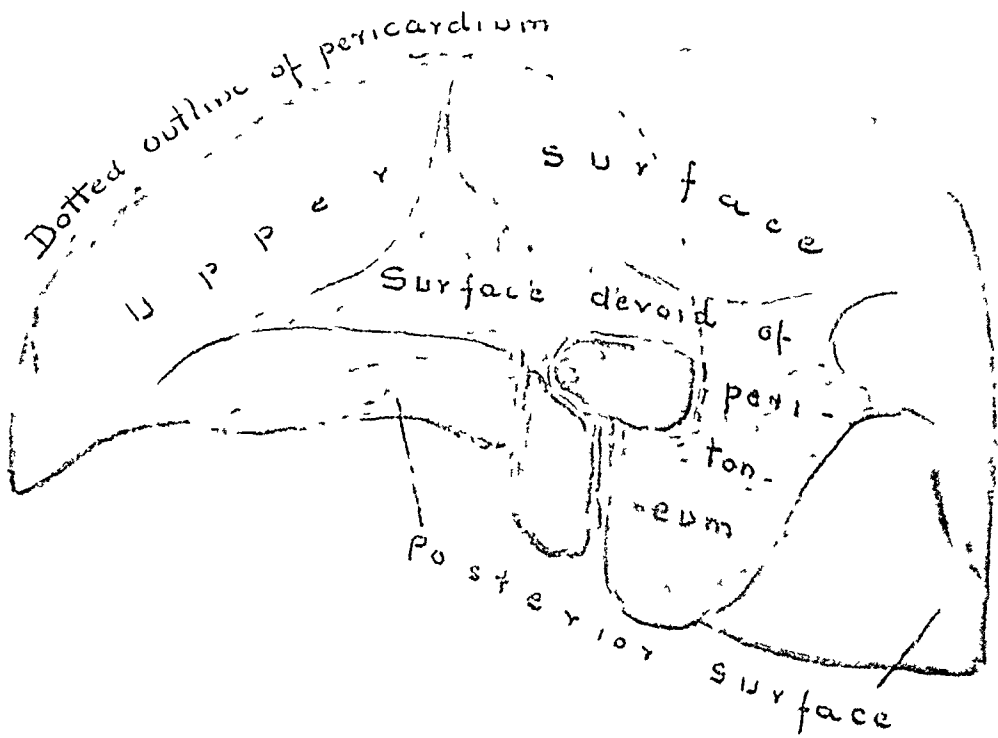
It has been stated by some writers that most liver abscesses that penetrate the diaphragm pierce it through this uncovered area. There is no doubt that it is a fairly frequent path of direct infection, but I have failed to find enough evidence to support

the statement It seems to be an easy matter for an abscess in any part of the liver to contract adhesions to the under surface of the diaphragm and to pass upward through it The frequency with which abscesses tend to point through the lower intercostal spaces in the axillary line, suggests at least that the peritoneum is no barrier If an abscess occupies the upper portion of the right lobe of the liver, as it increases in size it will bulge toward the pleural cavity and the first effect will be to push the diaphragm against the chest wall, and obliterate the lower portion of the phrenicocostal sinus (Fig 2) By doing so the lower edge of the lung is pushed upward, and is prevented from reaching the lower limit of this space even in forced inspiration If the abscess extends in this direction, adhesion of the two layers of peritoneum and pleura occurs in advance and both peritoneal and pleural cavities are obliterated at these points If, however, the abscess extends upward it may open into the pleural cavity above these adhesions, or directly into the lung if adhesions have formed between it and the upper surface of the diaphragm The structures lying on the upper surface of the diaphragm, that correspond to the upper surface of the liver, are the whole base of the right lung, the base of the pericardium, and part of the base of the left lung Fig 1 explains this clearly The area outlined in red represents the area of liver which is in relationship with the pericardium above It is seen to occupy almost the whole of the upper surface of the left lobe and a considerable part of that of the right lobe, including almost half of the area uncovered by peritoneum A very small area of the upper surface of the left lobe touches that part of the diaphragm in contact with the left lung The right lobe of the liver touches the diaphragm over the whole area corresponding to the under surface of the right lung Fig 2 is a right lateral, sagittal section, and shows the reflection of peritoneum in front and behind, from the upper surface of the liver on to the diaphragm and posterior body wall The phrenicocostal sinus is shown in front and behind

Secondary extension of the inflammation from the liver to the lungs may occur in one of two ways

- 1 By direct extension through the diaphragm
- 2 By embolism of the pulmonary arteries due to the abscess bursting into the hepatic veins or into the vena cava

FIG 1



Upper and posterior surfaces of liver. Shaded area uncovered by peritoneum.
Dotted line outline of pericardium. Most of this pericardial area is occupied by central tendon.

I DIRECT EXTENSION THROUGH THE DIAPHRAGM

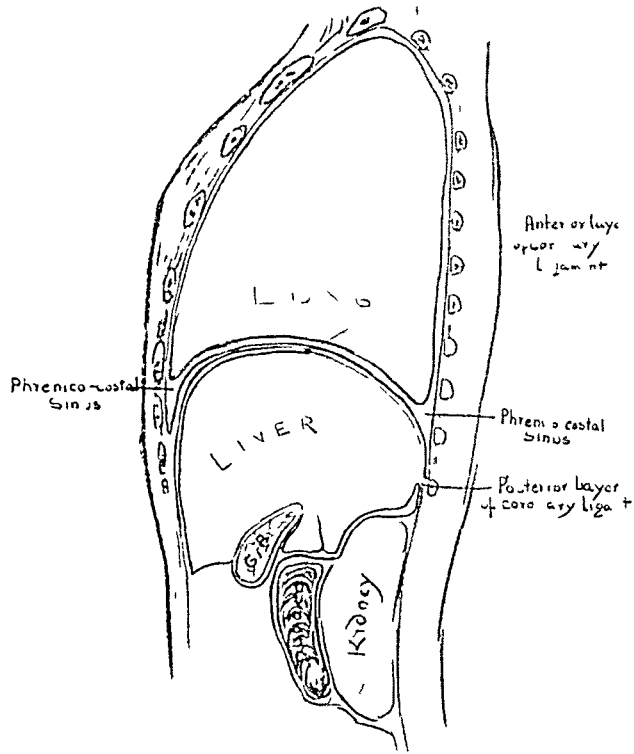
From the preceding anatomical description the paths of direct extension into the pleural cavity and to the lungs will be easily understood. The pleural cavity is probably never invaded by metastasis but always by direct extension, and the same path usually holds good for the lower lobes of the lungs. The process with a few modifications is as follows. Extension of the original liver abscess proceeds toward the diaphragmatic surface of the liver. The diaphragm is incorporated into the abscess cavity and is gradually destroyed. What occurs next will depend on a number of factors. If the necrotic process is rapid and no antecedent pleurisy has caused adhesion of the lower lobe of the lung to the diaphragm or to the chest wall, the pleural cavity will be opened and the contents of the abscess emptied into it suddenly, producing serious fulminating symptoms of dyspnoea and all the signs of an acute pleural effusion (Thomson). Usually the diaphragm is penetrated slowly and actual perforation is preceded by pleurisy, just as peritonitis precedes perforation of the abdominal viscera. The inflammation of the pleura may terminate in an accumulation of fluid, or in adhesions between the lung and the diaphragm or chest wall, or in both conditions to a different degree. In quite a large number of cases effusion is present in greater or lesser quantity. At first it is serous and sterile, later, it may become infected and seropurulent or purulent. At first the accumulation occupies the lower region of the chest cavity, the diaphragm forming its lower boundary. If no adhesions form between the lung and the chest wall the whole pleural cavity may become involved and filled with fluid. Owing to the frequency of adhesions between lung and parietal pleura, localized collections in the lower portion of the pleural cavity or even between the lung and diaphragm are more common.

When the diaphragm is perforated finally, the pus from the liver abscess mixes with the pleural fluid, imparting to it its own peculiar physical characteristics. The mingling of the two fluids is rarely attended by acute symptoms, because the pleural surfaces are now less susceptible to injury and the absorption of morbid products is less active. At the most,

there may be slight increase in pain or dyspnoea. The change of the fluid from serous to purulent may be discovered by chance even, at a subsequent tapping. When adhesions form between the diaphragm and the under surface of the lower lobe of the lung, the pleural cavity is shut off at an early date. As a rule, the application of the two surfaces is close and no cavity is left. But occasionally a small portion of the pleural cavity is imprisoned between the lower surface of the lung and the upper surface of the diaphragm. In the former case the inflammatory process passes slowly through the diaphragm into the lungs and the abscess cavity bores its way through the lung tissue until a bronchus is opened, into which the contents are finally discharged. In the latter the abscess opens first into the intervening cavity and later bores its way through the lungs.

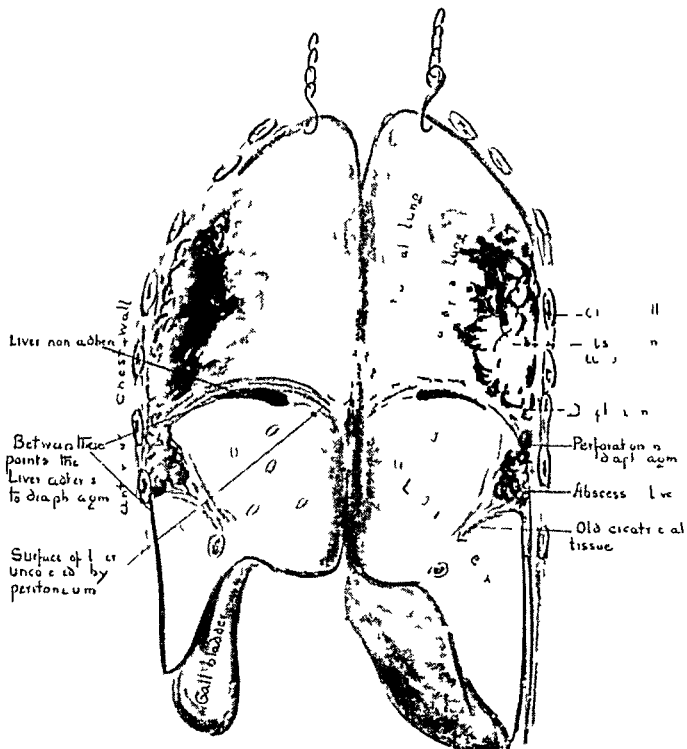
The post-mortem appearances of such conditions show marked anatomic variations. In some instances (usually recent cases) the hepatic abscess may still be of a reasonable size and the pulmonary track short and comparatively narrow. At a later date the track through the lung may be transformed into a large cavity which communicates with a similar cavity in the liver (Fig 4) (Strong). In others (older cases) the hepatic abscess may be reduced to a very small size, while the track in the lung may show extensive cavitation, of irregular shape and with ragged disintegrated walls. This disproportion between the cavities in the lung and liver is often so marked that the liver abscess may be considered as practically healed (Fig 3). The cause of death in such cases must not be ascribed to the destruction of liver tissue, but to the pleural or pulmonary complications, or, in rare instances, to metastatic infection of other organs. In one of our cases (Case X) an abscess had opened primarily into the lower part of the pleural cavity, the lung being penetrated secondarily. The post-mortem examination showed that the liver abscess had almost healed up and that nearly all the pus which was being discharged through the bronchi had been formed in the pleural cavity and in a cavity found in the lungs. The lower lobe of the right lung

FIG 2



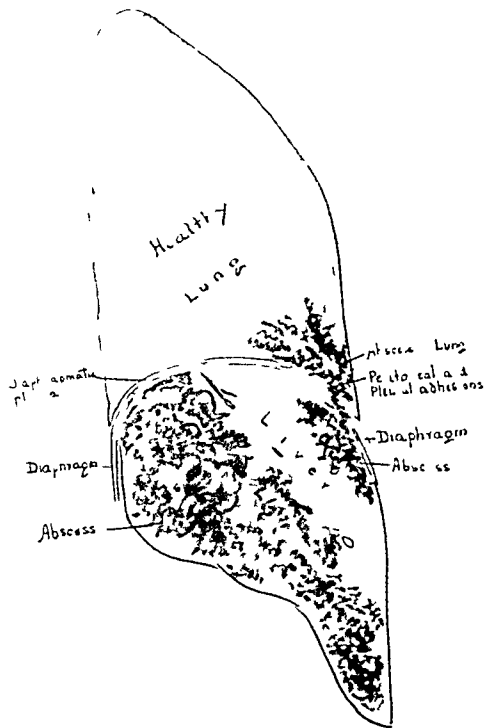
Right lateral sagittal section 3 inches from medial plane

FIG 3



Specimen of liver and lung laid open showing abscess in liver almost healed but abscess in lung very large and active (Path. Museum University of Texas)

FIG 4



Sagittal section of lung and liver showing multiple abscesses in the liver and a small abscess in the lung communicating with one in the liver (Path Museum University of Texas)

was occupied by a cavity as large as a man's fist, the walls of which were disintegrated and friable. The contents consisted of pus of a chocolate color. The cavity drained externally into a large bronchus and opened by a small aperture into the pleural cavity. There was no direct connection between it and the liver. Careful examination of the upper surface of the diaphragm revealed a shallow excavation in its upper surface not more than one-half an inch deep and three-fourths of an inch wide. The walls of this cavity were formed by cicatrized liver tissue. Section of the neighboring liver showed an insignificant amount of cicatricial tissue. A profuse amount of pus typical of liver disintegration had been discharged daily for months in the expectoration and by drainage from the thoracic cavity. Death finally resulted not from liver or lung infection, but from infection (abscess) of the brain. In another case (Case XI) recently observed, giving a typical history of hepatic abscess with pleural and pulmonary involvement associated with expectoration of large quantities of chocolate pus, the lower portion of the pleural cavity and the upper surface of the diaphragm were fully exposed to view by an extensive excision of the chest wall. No trace could be found of a liver abscess, although a most minute search was made. The pleural cavity contained a large quantity of thick, white pus mixed with masses of chocolate colored pus. We were also unable to find the opening from the pleural cavity into the lung. As this case recovered it is within the bounds of possibility that our observations may be incorrect. A similar case is quoted by Marion.

We have strong evidence pointing to transference of the amœbic infection from the liver to the lungs, for Lafleur and others have shown that the walls of the pulmonary cavities contain amœbæ, and they ascribe the extensive destruction of the lung to the agency of these organisms. It is impossible to explain the persistence of the symptoms and the extension of the ulceration by any other hypothesis. I have been able to collect some cases that seem to me to admit of no other interpretation. Such are the cases reported by Roch, Suzuki,

Cantlie, Godlee and others, in which the presence of a liver abscess was clearly demonstrated as the primary infection either at autopsy or during life. In each one of these cases the liver abscess had healed up and the cause of death was abscess of the lung. Marion and Natton-Larrier have reported cases of amoebic abscesses of the lungs in which the symptoms pointed strongly to hepatic abscess as a primary condition, but in which no liver abscess could be demonstrated at the time of operation. Appended here are short résumés of the cases mentioned above.

I INFECTION OF THE LUNGS BY DIRECT INVASION

ROCH reported a case in which the liver abscess penetrated the diaphragm and chocolate pus was expectorated. Death finally occurred from exhaustion. At the autopsy there was only a cicatrix to show the site of the liver abscess. The entire base of the right lung was occupied by purulent cavities.

SUZUKI mentioned a case of successful operation for hepatic abscess following dysentery. Eight months later an abscess formed in the upper lobe of the right lung, which was opened successfully.

CANTLIE reported a case of successful operation on a liver abscess. Six months later empyema of the right pleural cavity developed. After draining, the patient died. Autopsy showed an abscess in the upper lobe of the right lung. The liver abscess had healed completely.

GODLEE. Three such cases are reported by Godlee.

(1) CASE 8—A patient spitting up chocolate-colored pus was operated upon and an abscess in the base of the right lung opened. The finger was passed through the diaphragm into an abscess cavity in the liver. Two months afterward the patient died from hæmoptysis. The autopsy showed irregular cavities in the right lung, but that in the liver had healed up.

(2) CASE 9—A patient with abscess of the liver began to spit up chocolate-colored pus. Eventually, an abscess in the base of the right lung was opened on two occasions. Death occurred from abscess in the brain. The autopsy showed little or nothing to indicate the old abscess of the liver.

(3) CASE 10—A patient with abscess of the liver developed signs of an abscess at the base of the right lung. This was opened and drained. He eventually died from an abscess in his brain. The autopsy showed an extensive abscess in the lung, but nothing except adhesions between the liver and diaphragm to indicate the old abscess in the liver.

MARION reported a case of abscess of the lung, with profuse expectoration of pus containing no other organisms except amoebæ. The patient had suffered from several attacks of amoebic dysentery. Abscess of the liver was suspected but not found either by aspiration or at operation. Resection of ribs revealed adhesion of lung to diaphragm, but no abscess.

in the liver (compare our cases) An amœbic abscess the size of an orange was found in the lower lobe of the right lung The patient recovered

NATTON-LARRIER reported a case of a patient with a history of dysentery, who developed an amœbic abscess in the lower lobe of the right lung During operation for draining the liver abscess, no affection of the liver was discovered The patient recovered

2 INFECTION OF THE LUNGS BY EMBOLISM

Compared with direct invasion, infection by this route is very infrequent Many reported cases are open to serious doubt because of the carelessly conducted autopsies Others must be accepted unequivocally

The one reported by Colin is typical of this condition A patient with abscess of the liver died with symptoms of intense dyspnœa and asphyxia The autopsy showed an abscess of the liver which had opened into the ascending vena cava Scattered abscesses were found in both lungs

LAFERRÈRE reports a case of abscess in the left lobe of the lung consecutive to one in the right lobe of the liver

BUNTING mentioned a case of amœbic abscess of the liver with no involvement of the diaphragm or pleura, in which an abscess cavity was present in the upper lobe of the right lung There were absolutely no signs of direct extension of communication between the two abscesses

On reflection it is rather remarkable that this mode of infection should be so rarely encountered Perhaps the low intensity of the inflammation, the extent of fatty degeneration in the liver tissue surrounding the abscess cavity, and the frequent absence of microorganisms other than amœbæ explain the rarity of embolism, or, on the other hand, it is probable that the lungs are particularly resistant to the invasion of amœbæ under ordinary conditions That under certain conditions amœbæ do pass from the abscesses into the hepatic veins and into the lungs and even through their capillaries into the systemic circulation is shown by the appearance of cerebral abscesses of embolic origin, containing amœbæ One of our cases (Case X) at autopsy showed an abscess in each frontal lobe and in the left lateral cerebellar lobe Many such cases have been reported

PROTHERAT reported a case of amœbic liver abscess, with purulent expectoration also containing amœbæ. The patient died with marked cerebral symptoms and the autopsy showed a brain abscess containing amœbæ. Kartulis has stated that brain abscesses occur in 3 per cent of all liver abscesses.

SYMPTOMS OF PULMONARY AND PLEURAL INVOLVEMENT

Added to the symptoms of hepatic abscess, the first sign of importance is severe pain in the shoulder. This is always a symptom of diaphragmatic involvement. It may be accompanied by increase in pain and tenderness over the lower part of the chest, which is suggestive of involvement of the lower portion of the pleural cavity. A distressing tickling or hacking cough may be present at this time, with or without any signs of pleural effusion. The symptoms increase in intensity until, without any other warning, the patient may expectorate suddenly a large quantity of chocolate-colored pus. Temporary relief of the symptoms follows and the patient may improve daily in health, if the drainage is free and if too much liver tissue has not been destroyed. When the drainage is free, pus flows without hindrance into the bronchi and is expectorated constantly. As time passes the quantity expectorated diminishes, and in some (rare) cases the abscess cavity may heal up completely and a spontaneous cure may result. In other cases drainage may be intermittent. Periods of profuse flow alternate with those of scanty flow or it may even cease for a time. During the periods of profuse flow the patient is free from pain and fever. When the flow ceases, pain and fever return again. In cases that drain poorly the outlook is serious, because the conditions favoring progressive necrosis of liver tissue are still present, and, further, the continued use of the lung as a channel for the discharge allows the amœbic infection to gain a stronghold in lung tissue and to cause extensive destruction and cavitation.

The foregoing description applies to that class of cases where adhesions between the lung and diaphragm have preceded the pointing of the abscess. Where no adhesions have formed the abscess opens directly into the pleural cavity and fills it more or less. Signs of serous effusion often antedate

actual perforation, in which event, except for an increase in the quantity of fluid, the physical signs do not alter. In such cases it is often impossible to determine the time of actual perforation, symptoms of empyema being gradually added to those of serous effusion. The change in the character of the fluid is often discovered by chance after aspiration. In the event of perforation of the abscess into an intact pleural cavity (probably very rare) very acute symptoms come suddenly. Pain and dyspnoea are intense. The whole pleural cavity may fill up in a very short time and the lung may be acutely compressed. If these cases are left to Nature and the pleural cavity is not drained, the outlook is very grave. Spontaneous evacuation of the accumulation may occur through the lung or through the chest wall. The former route is probably the most frequent. Even in cases that are drained, the mortality is very high. Pus is often discharged through the chest wall and into the bronchi simultaneously and in many instances drainage of the pleural cavity fails to relieve the expectoration completely. Some cases recover, but many of them die from exhaustion. Occasionally, cavities form along the drainage track in the lung in spite of external drainage, and from them pus of a chocolate color is expectorated constantly.

FREQUENCY OF PLEURAL AND PULMONARY INVOLVEMENT

This has been estimated variously by different writers.

Rendu, analyzing 563 cases, found 31 cases where the abscess had opened into the pleural cavity, or 5.5 per cent. Molinié stated that it occurred in 8.9 per cent of cases, 5.5 per cent for the opening of the abscess into the pleural cavity and 3.4 per cent for the presence of serous effusion. Harris found the pleural cavity involved 3 times in 95 cases. Fitcher, in 119 cases, found the lung involved in 6 and the pleural cavity in 3 cases. Strong, in 100 fatal cases, found the lung involved in 1 case and the pleural cavity in 2 cases.

Our cases show a marked contrast. In 27 cases we found the lung and pleural cavity affected in 11, *i.e.*, 40.8 per cent.

PROGNOSIS.—This can be more conveniently discussed under two heads.

- 1 The prospects of spontaneous cure
- 2 The results of operative procedures

1 *Spontaneous Cure*—This result may be hoped for in a small proportion of cases in which the abscess penetrates the lungs directly without infecting the pleural cavity, but it probably never occurs when the pleural cavity forms an intermediary channel between the liver and the bronchus. Quite a number of cases have been reported from time to time that can be accepted without cavil as instances of real cures. Such are two reported by Vertiz, where a period of good health had elapsed, without bad symptoms, long enough to justify the conclusion that the abscesses in both liver and lung had healed. Others cannot be accepted without question. Such are two reported by Phillips, which were treated with ipecac and emetin, but were under observation too short a time to justify the conclusion that they were cured. It has been my privilege to see five cases where the abscess opened directly through the lungs. Of these only one certainly recovered (Case VII), not spontaneously, but following excision of the chest wall, and drainage of the abscess cavity. Another (Case VI) left hospital in 30 days, still expectorating chocolate-colored pus and having a septic temperature. A third (Case V) died in hospital four months after admission from exhaustion, spitting chocolate-colored pus to the last. The two others are not in the case reports, having been under observation prior to the year 1907. Both died eventually from exhaustion, with every symptom of pulmonary abscess, spitting chocolate-colored pus to the last. In only one, *ie*, the case that recovered, was the abscess located by aspiration. We failed signally to find the abscess cavities by the aspirating needle in all the rest.

2 *The Results of Operative Procedures*—The mortality of hepatic abscess in general is always high. Varonoff collected 1089 cases which were operated on in Egypt, during a period of 25 years, and found a mortality of 34 per cent in those operated on by a large incision, and a mortality of 60 per cent in those treated with the trochar and cannula. Martin, in Cambodge, found a mortality of 37.5 per cent. Gaide, in Toulon, found a mortality of 33 per cent. The best statistics

on a series of consecutive cases is given by Cantlie. Out of 100 cases there were 82 recoveries and 18 deaths, a mortality of only 18 per cent. Of these cases 90 were treated by evacuation with a trochar and cannula (Manson's method). Our own mortality for the cases reported was, roughly, 29 per cent.

A separate analysis of the cases showing pleural and pulmonary complications reveals an enormous increase in the mortality. According to Molinié the mortality is as high as 84.8 per cent. Our own mortality for a consecutive series of cases amounts only to 45.4 per cent, but the number is small. It is my conviction that a mortality of 75 per cent would represent an average. If every case leaving hospital could be followed up many of those discharged as improved would be found to have died of exhaustion. An analysis of our own reports will explain this statement.

I have made an analysis of our own reports since 1907, and find that 27 cases of hepatic abscess have been operated upon. The results which I have tabulated very carefully are as follows:

Cured	13, roughly,	48 per cent
Improved	6, roughly,	22 per cent
Died	8, roughly,	a mortality of 29 per cent

CONDITION OF THE 13 CURED CASES WHEN DISCHARGED

No 1	was discharged in 30 days	with normal temperature	
No 2	was discharged in 21 days	with normal temperature	
No 3	was discharged in 40 days	with normal temperature	
No 4	was discharged in 3 months	with normal temperature	
No 5	was discharged in 2 months	with normal temperature	
No 6	was discharged in 49 days	with normal temperature	(Case VII)
No 7	was discharged in 3 months	with normal temperature	(Case IX)
No 8	was discharged in 44 days	with normal temperature	(Case II)
No 9	was discharged in 20 days	with normal temperature	
No 10	was discharged in 22 days	with normal temperature	
No 11	was discharged in 31 days	with normal temperature	
No 12	was discharged in 3 months	with normal temperature	
No 13	was discharged in 30 days	with normal temperature	

None of these cases left hospital with any fever. Some had a slight discharge that required a dressing, but the condition of

all of them was practically well Of them three (Nos 6, 7 and 8) were complicated with pus in the pleural cavity

CONDITION OF THE 6 CASES MARKED IMPROVED WHEN DISCHARGED

No 1 was discharged in 26 days	Temperature slightly elevated
No 2 was discharged in 24 days	Temperature septic, 99° to 102°.
No 3 was discharged in 60 days	Temperature septic, 90° to 102°
No 4 was discharged in 30 days	Temperature septic, 99° to 102°
Spitting pus (Case VI)	
No 5 was discharged in 3 months	Temperature septic, 99° to 102°
Spitting pus (Case IV)	
No 6 was discharged in 36 days	Pleural cavity wide open and lung collapsed Spitting up pus (Case XI)

It is evident that the condition of these patients was anything but satisfactory and some of them eventually died of exhaustion There were *three* of these suffering from pleural and pulmonary complications (Nos 4, 5 and 6)

DEATHS

TIME OF DEATH AND CAUSE OF THE 8 DEATHS

No 1 died at the end of 4 months	Uncomplicated abscess	Died of exhaustion
No 2 died at the end of 48 days	Perforated the diaphragm	Opened into pleura and lungs Very septic (Case VIII)
No 3 died at the end of 4 months	Perforated diaphragm and opened into the lungs	Exhaustion (Case VI)
No 4 died at the end of 28 days	Infected pleural cavity	Exhaustion (Case III)
No 5 died at the end of 66 days	Opened into pleural cavity, and lungs	Very septic (Case I)
No 6 died at the end of 16 days	Uncomplicated abscess	Death from peritonitis, following perforation of ulcer of cæcum
No 7 died at the end of 40 days	Pleural cavity and lung infected	Death from cerebral abscess (Case X)
No 8 died at the end of 18 days	Uncomplicated abscess of left lobe of liver	Exhaustion

It will be seen that five of the eight deaths (*vid* Nos 2, 3, 4, 5 and 7) occurred in cases where either the pleural cavity or lungs or both were affected, *i e*, 62.8 per cent of the deaths occurred in this class of cases

Out of the 27 cases, there were 11 with *pleural and pulmonary complications*, *i e*, 40.8 per cent, of these 5 died, *i e*, a mortality of 45.4 per cent

The following is a brief abstract of these cases

CASE I—Male, white, aged forty-nine Abscess of right lobe of liver which had perforated diaphragm Pleural cavity full of pus Also coughed up quantities of pus. No amœbæ found Drained with Manson's trochar, afterwards excision of ribs No abscess found in liver Continued to spit up quantities of chocolate-colored pus even after drainage Died of exhaustion at the end of 66 days (*vid* No 5, deaths)

CASE II—Male, aged twenty-nine Abscess of right lobe of liver Lower part of pleural cavity full of chocolate-colored pus Amœbæ absent Pleural cavity drained with trochar and cannula Recovered (*vid* No 8, cures)

CASE III—Female, colored, aged forty Abscess of right lobe of liver Right pleural cavity full of pus, chest wall œdematous from fifth interspace down Breathing labored No spitting of pus Pleural cavity drained with trochar and cannula No amœbæ found Drainage free Death from exhaustion in 28 days (*vid* No 4, deaths)

CASE IV—Male, negro, aged twenty-seven Abscess of right lobe of liver Ruptured into the pleural cavity and lung Spitting up of chocolate-colored pus Amœbæ present at first in sputum and in pus aspirated from pleural cavity, but disappeared during convalescence Pleural cavity drained Discharged from hospital in 3 months with septic temperature and wound in chest still draining (*vid* No 5, improved)

CASE V—Male, white, aged fifty Abscess of right lobe of liver, which had perforated into the right lung Expectoration of chocolate-colored pus Pleural cavity intact Aspiration of liver failed to reach abscess cavity Expectorated constantly Died at end of 4 months from exhaustion No autopsy (*vid* No 3, deaths)

CASE VI—Male, white, aged twenty-eight Abscess of right lobe of liver Perforation into the lung Pleural cavity intact Expectoration of chocolate-colored pus containing amœbæ An attempt was made to reach the pus with an aspirator, but it failed Discharged from hospital in 30 days with septic temperature (*vid* No 4, improved)

CASE VII—Male, white, aged forty-nine years Abscess of right lobe of liver Spitting up of chocolate-colored sputum, containing amœbæ Pleural cavity intact Excision of seventh and

eighth ribs Diaphragm stitched to chest wall Opened and drained abscess in upper part of liver Cured in 49 days (*vid* No 6, cured)

CASE VIII—Male, white, aged sixty-one years Abscess of right lobe of liver Perforation into the pleural cavity Rupture into the lung and profuse expectoration of chocolate-colored pus No amœbæ found Pleural cavity drained Death in 48 days from exhaustion No autopsy (*vid* No 2, deaths)

CASE IX—Male, negro, aged thirty-five years Abscess in right lobe of liver Perforation into the right pleural cavity Chocolate-colored pus aspirated from both situations No amœbæ found Amœbæ present in the fæces Pleural cavity drained after excision of part of the seventh and eighth ribs Liver abscess drained through same opening Recovery in three months (*vid* No 7, cured)

CASE X—Male, white, aged forty-six Abscess in right lobe of liver Perforation into right lung and pleural cavity Spitting up of large quantities of chocolate-colored pus Amœbæ present in the pus Amœbæ also present in the stools Pleural cavity full of pus Drainage of pleural cavity by trochar and cannula, followed by great improvement in general symptoms Subsequent excision of a large part of the bony wall of the right thorax Lung collapsed. No abscess could be found in liver Death in 40 days Liver abscess was practically healed The lower lobe of right lung contained a large abscess cavity Lung was collapsed (*vid* No 7, deaths)

CASE XI—Male, white, aged sixty-two Abscess of right lobe of liver Perforation into right pleural cavity and lung Expectoration of large quantities of chocolate-colored pus Pleural cavity had been drained six months previously Aspiration of cavity revealed chocolate-colored pus Drainage with trochar and cannula Slight improvement Subsequent removal of a large part of the bony wall of thorax No abscess was discovered in the liver Lung was collapsed, but opening into it from pleural cavity could not be found, although fluid ran freely from pleural cavity into the air passages Discharged from hospital in 36 days, with pleural cavity wide open and lung collapsed, also, with expectoration of chocolate-colored pus (*vid* No 6, improved)

TREATMENT —Early diagnosis and prompt evacuation of the original abscess cavity is not only attended by a very low mortality, but is an effectual means of preventing these complications. A very large proportion of abscesses in the right lobe of the liver are capable of diagnosis long before they have penetrated the diaphragm, and they can be opened and drained with a trochar and cannula with every prospect of success. The cases that are difficult to diagnose and to reach with an aspirator are abscesses situated in the posterior and upper part of the right lobe near its junction with the left lobe. Some of them cause no local symptoms, except diffuse pain over the liver, until the diaphragm is involved, when pain in the right or left shoulder may be complained of. It is in such cases that sudden perforation into the lung and profuse expectoration of pus occurs so frequently. This accident sometimes happens without the patient knowing that he is suffering from liver abscess. Aspiration often fails to reveal pus in this portion of the liver, because sufficient care is not taken to search for it in the right direction and to a proper depth. Cantlie has given careful attention to the proper method of aspirating the liver and has formulated the following rules from measurements made on the cadaver. In a patient the circumference of whose body is 32 inches over the middle of the hepatic area, the vena cava inferior lies at a depth of $4\frac{1}{2}$ to 5 inches from the surface of the body, along a line drawn backward horizontally (in the upright posture) from the xiphisternal articulation in front to the angle of the ribs behind. He also found that the vena cava is equidistant from any point in the usual operative area. Aspiration should be made systematically in a horizontal direction, penetrating the liver from right to left, each successive puncture being posterior to the previous one. By this means, a larger area of liver surface is explored than can be done with punctures in different directions. Even after most painstaking and repeated aspirations, failures are very common and the abscess may eventually penetrate the diaphragm. The course to pursue after the abscess has penetrated the diaphragm depends on the pathological condition of

the structures involved *If the pleural cavity is not infected, i e*, if the lung has adhered to the diaphragm before perforation and the abscess has opened into a bronchus through lung tissue, it is better to wait awhile to see what will happen. Some few cases recover spontaneously. The liver abscess collapses and cicatrization follows, both in liver and lung. This result is only reached after a tedious convalescence and is probably a rare termination. What usually occurs is that the abscess fills up and empties itself intermittently, because for some reason the track through the lung becomes blocked or obstructed from time to time. A persistence of this condition is likely to terminate in infection of the walls of the pulmonary track with amœbæ, which in turn will result in destruction and cavitation. Two cavities will then be present, one in the liver and the other in the lung, communicating with one another. Finally, that in the liver may heal up completely, but the cavitation persisting in the lung may extend and prove fatal. An accurate estimate of the true anatomical condition of the infected cavities is rarely possible. It is, however, necessary to bear in mind always that, at the time the case comes under observation, there may be no longer any abscess cavity in the liver. It is easy to understand why so many failures to reach the abscess cavity have been recorded. Even in cases where the abscess cavity in the liver still exists, it is practically hopeless to reach it while expectoration is free and profuse, because the walls are collapsed and the cavity is very small. The only time when aspiration is justifiable is when the expectoration ceases and the patient is febrile (*i e*, when the abscess cavity is full). Even under these circumstances successful aspirations are rare. Still, it is probably the best course to pursue and repeated attempts should be made before abandoning this method as not feasible. If aspiration fails an attempt may be made to reach the collection (1) by the abdominal or (2) by the transthoracic route. The abdominal route is hardly advisable in abscesses penetrating the right lung, because it is impossible to get within a reasonable distance of the point of perforation. Cantlie advises it strongly in abscesses of the left

lobe Through an incision in the left rectus the hand is thrust into the abdomen and the area of adhesion between the liver and diaphragm palpated An aspirating needle is now thrust through the lower intercostal spaces in the direction of the abscess, being guided in its direction by the fingers in the abdominal cavity The transthoracic route has been condemned because it may endanger the integrity of the pleural cavity If conducted carefully by the method of Lannelongue, the cartilages of the seventh, eighth and ninth ribs can be removed and a large area of the upper surface of the liver uncovered by diaphragm can be rendered accessible McLeod insists that a transthoracic operation is the only logical route, and bases his argument on the contention that the pathological focus in most cases is in the lung and not in the liver, because in this stage the liver abscess has healed up It appears to the writer that this contention is well sustained by many post-mortem examinations, and that well conducted transpleural operations offer the best prospect of ultimate cure The cases reported by Godlee support this position strongly

If the pleural cavity is infected the problem becomes less complicated It should be opened at once and a drain inserted If necessary a segment of one or more ribs should be excised If the condition of the patient allows it, the upper surface of the diaphragm should be examined and, if possible, the opening into the liver abscess found, enlarged if necessary and the cavity drained Prompt attention will often save the lives of some of these patients Collapse of the lung is often present and in old standing cases it is very unlikely that a great deal of expansion will follow even after decortication operations A large number of these patients die sooner or later from exhaustion In some instances the pleural cavity may contain pus which is being discharged into the lung and coughed up As described above, the pleural cavity may be a reservoir and the lung tissue serve as a track or sinus along which the pus passes On the other hand, the pus may pass from the pleural cavity into a lung cavity and thence into a bronchus As previously stated, the liver abscess may be present or may have healed

up Such cases are almost hopeless Even where no lung abscess is present the prospects of permanent cure are very slight. In the presence of a lung abscess, cure is very improbable Still, we should do all we can The lung abscess should be opened and drained, likewise, the liver abscess if it exists

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THE CAUSAL RELATION OF TRAUMATISM TO TUBERCULOSIS.*

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THE Courts of Philadelphia and, I doubt not, the Courts elsewhere, are at times obliged to consider the question of the relation of trauma to tuberculous lesions—pulmonary, glandular, osseous, and articular

The law is often an organized and methodical bewilderment. Lawyers are professional bewilderers who are occasionally accurate and truthful and then not always from virtue, but sometimes perhaps from necessity or deep design. They raise a cloud of dust to obscure the facts and then vainly try to find a way out. The Judge may be a self constituted oracle of surgical knowledge, an irritable repudiator of everything modern and reasonable, or he may sit in dignified isolation from all mundane annoyances and all irritating and contaminating truths. Medical witnesses are often partisan and controversial, are not very unusually inaccurate and unreliable, and are sometimes actually mendacious. Some of them cheerfully swear to things they would not bet on. The elder Dumas said that it is the book which it is impossible to read which creates a sensation. The same may be said of dinners it is impossible to eat, and of testimony it is impossible to understand. In the average damage suit there is much contradictory testimony from medical experts. Some of the testimony may have as little meaning as the frozen words which fell upon the deck of Pantagruel's ship. The Judge and jury, even if instigated by the best intentions, may pass into the deepest error and so the wrong may triumph. Surely a more stupid method

* Read by title before the American Surgical Association, April 12, 1914

of seeking truth and hence of obtaining justice could scarcely be devised. Such views will not be popular with lawyers and professional medical experts, but in the words of Paul to the Gallatians, "Am I become the enemy because I speak the truth?"

In a Philadelphia case, in which it was claimed that the plaintiff suffered from traumatic tuberculosis of the lung, the learned judge, apparently indignant at the mere mention of such a thing, directed the jury "to exclude all evidence touching the question of traumatic tuberculosis as fully and conclusively as if none had been offered," maintaining that "the attribution of tuberculosis to trauma does not rise above the grade of a theory adopted by a small number (a most respectable number it is true) of one profession"¹ The judicial light above quoted calmly settled the whole question off-hand and without mental effort, and decreed that hereafter traumatic tuberculosis was to have no standing in court. Lawyers express surprise that medical experts ever disagree. Lawyers always disagree. There is at least one on each side of every case, the judge often disagrees with both of them, and the Supreme Court, which has the last guess (by a majority vote), often reverses the verdict of the lower court. In the case cited above, the Superior Court of Pennsylvania disagreed with the trial judge and reversed the judgment, declaring that the testimony relating to traumatic tuberculosis "should have been submitted to the jury for its consideration"² The Court said "There is a clear distinction between the guess and conjecture that is inveighed against by some judges and some text writers, and the carefully formed opinion of capable, honest and eminent physicians"³ In the trial of the case one expert testified that a man has eleven ribs. As Mark Twain said of Fennimore Cooper—he dealt "freely in important omissions." Perhaps he was seeking to justify the narrative in Genesis which tells of the creation of Eve. In the second trial a new medical witness was discovered by the defendant. He swore that he had attended the plaintiff three years before the accident and had a record of the case in his case book, and that long

before the accident the claimant was the victim of pulmonary tuberculosis. In the first trial one expert swore that the relation between the injury as a cause and the existing condition of the patient was obvious, and unhesitatingly affirmed that the tuberculosis was caused by the injury. In the second trial some of his views had undergone a sort of benevolent assimilation from the outside. His revised statement was that nothing in the case independent of the history could lead him to regard the condition as "traumatic consumption." The judge in his charge attached great importance to the testimony of the witness who swore that he had attended the plaintiff long before the accident and had attended him for consumption, yet the jury brought in a large verdict for the plaintiff.

Such are some of the confusions relating to this subject. Such are some of the vagaries of judges, attorneys, expert witnesses, and jurors.

Because of the unsettled opinions and divergent views made evident by the case cited above it seems worth while to review and bring together what we do know about the alleged relationship between trauma and tuberculosis—to try to discriminate between known facts and wild guesses, between reasonable deductions and fanciful conjectures. The question is as follows: Is an injury ever a determining cause of a tuberculous lesion? We all know that tuberculosis may follow injury, but that one thing follows another thing is no proof that the first was the cause of the second. To prove that tuberculosis can result from an injury we must prove that injury has a tendency, under certain conditions, to determine lesions of tuberculosis.

Until 1882 the opinion was general that injury was causal of what they then called a scrofulous joint, a strumous joint, fungous arthritis or white swelling.

Erichsen⁴ expressed the general view. In speaking of "strumous" joints he says: "This condition has not in many cases any definite starting point but appears slowly to supervene upon some slight injury, as a twist, or blow, or strain,

at other times it commences with a subacute synovitis, assuming its peculiar characters by occurring in a strumous constitution and is especially liable to happen in children and females" Samuel D Gross⁵ was one of the very few to emphatically deny a local origin of tuberculous joints. He considered the exciting causes to be "very obscure, if not utterly inscrutable. The surgeon is often told that the patient, perhaps weeks or months before the appearance of the characteristic phenomena, received some injury, as a blow, fall or kick, or that the affected joint had been sprained, bruised, or twisted, but such information is usually not trustworthy, or if such an occurrence did take place, it probably exerted little, if any, influence in developing the complaint." Gross named many conditions as predisposing causes, saying "Whatever has a tendency to enfeeble the system or to derange the blood are so many predisposing causes of the disease, if they do not actually call it into activity." Among these alleged causes he mentioned typhoid fever, measles, small-pox, scarlatina, chronic diarrhœa, protracted courses of mercury, copious and repeated hemorrhages, chronic digestive disorder, unwholesome food, poor assimilation, imperfect nutrition, and infantile cholera.

We know in this day that some of the conditions mentioned by Gross did not produce tuberculous joints, but did produce special forms of joint disease not then identified. This is true, for instance, of typhoid fever. The other conditions could favor the development of tubercle in the body by lowering general body resistance but could have no power in determining its location in bone, joint or pulmonary tissue.

Max Schuller's⁶ widely quoted experiments were made in 1880. They seemed to indicate the tuberculous nature and the frequent traumatic origin of "strumous synovitis." Schuller performed tracheotomy upon dogs and rabbits, injected tuberculous material through the tracheal openings and at the same time injured the right knee-joint of each animal. As a result some of the animals developed general tuberculosis and some a condition that appeared histologically to be tuberculosis of the damaged joint. In no instance did a joint which had not been injured become tuberculous.

Gibney, in 1877,⁷ asserted that traumatism was causal in forty-two per cent of his cases of joint tuberculosis.

Koenig⁸ maintained the causal influence of trauma in at least half of the cases of tuberculous joints

Téissier⁹ believed that an injury of the chest followed by hæmoptysis might be responsible for the development of pulmonary consumption

According to Oliver,¹⁰ Perrond in 1875 claimed that the frequency of phthisis among the boatmen of the Rhone was due to the men "leaning with their chest wall upon the pole of the rudder in steering their ships. It was thought that the repeated pressure favored the development of pulmonary lesions, the interesting point being that the maximum focus of the disease, as revealed by auscultation, always appeared to be located at the level of the point of pressure by the pole, viz, under the right clavicle"

In 1882 Koch discovered the tubercle bacillus and this discovery strengthened the belief of all who denied the influence of traumatism in the production of local tuberculosis. They said "the disease can be caused by the bacillus alone. Traumatism cannot cause the bacillus. Hence injury is casual, never causal"

W. Muller,¹¹ experimenting on the bones of goats, injected tubercle bacilli into the nutritive arteries without inflicting trauma on the bones and tuberculous osteomyelitis developed. This seemed like experimental proof of what every one knew, that the condition could develop without trauma. Lannelongue and Achard¹² injected tubercle bacilli into guinea-pigs and in from nineteen to twenty-one days later produced bone injury and joint damage, yet tuberculous disease did not arise in the damaged areas. In these cases the injuries were inflicted at too late a period after injections.

Friedrich¹³ actually asserted that joints subjected to traumatism were less likely to become tuberculous than uninjured joints. Some corporations would be glad to pay money to have this view petrified into established law. It is worthy of note that Friedrich used attenuated cultures in his inoculations.

Frazer¹⁴ by injecting bacilli into the nutritive arteries did not produce tuberculous osteomyelitis. Krause¹⁵ injected guinea-pigs and rabbits with pure cultures of the bacilli. At the time of the injection or very soon afterwards, he broke a bone and injured a joint. In no case did the seat of fracture become tuberculous. In one-third of the guinea-pigs and one-half of the rabbits the injured joint became tuberculous. In only one case did a joint which was not injured become tuberculous.

Salvia¹⁶ injected rabbits with virulent cultures and claimed that injury localized tubercle. Animal experiments are inconclusive and contradictory.

Drs. H. A. Wilson and Randle C. Rosenberger¹⁷ say, "it is impossible to accurately compare animal experiments with the process as seen in human beings, for the reason that the means of infection employed in animals essentially differs from the infection of children. Animal experiments are wholly artificial, and necessarily so. Direct inoculation of a child's joint does not occur, nor is trauma of any kind ever applied in the manner resorted to in experimentation. The results of animal experimentation are therefore interesting, instructive, and illuminating, but

too much reliance should not be placed upon them in determining a solution of the problem. Very little information is obtainable as to the kind of trauma that was employed in the experiments. It is impossible, therefore, to determine the relative value, as causative or contributory factors, of severe injuries, sprains, contusions, lacerations, bruises, indirect trauma and functional trauma."

At the present time some surgeons absolutely deny any relation between trauma and tuberculosis. Richard Stern¹⁸ states that most surgeons, judging from clinical experience, deny that trauma is concerned in the development of osseous or articular tuberculosis and that if it appears to be, the bone or joint was previously tuberculous.

Nicholas Senn¹⁹ in 1892 affirmed with emphasis that trauma can only be an exciting cause of tuberculosis of bone in a person "already infected with the essential cause." He did not say that a person must have a lesion of tuberculosis. He states specifically that the *bacilli* must be present in the *tissue* or in the *blood* at the time of the injury.

Wilson and Rosenberger²⁰ emphatically deny that trauma has any "existence in the etiology or in the beginning of the process" in bone or joint tuberculosis.

Many surgeons still affirm a relationship. All admit that a local quiescent focus may be lighted up by an injury. Nobody believes that injury under any circumstances causes the bacillus. Nobody believes that injury without the bacillus is under any circumstances capable of causing those tissue changes which we call tuberculous. What many do believe is that injury may determine the development of tuberculosis in a part previously free from lesion. Among the many surgeons who believe that injury may determine the development of tuberculosis we may mention Bradford and Lovett, W. Watson Cheyne, Nichols, Bryant, Sir Frederick Treves, Tillmanns, Golthwaite, Voss, and H. L. Taylor. Many medical writers never speak of the matter at all. Jacoud of Paris²⁰ in 1896 reported a case of phthisis which he believed to be due to traumatic pneumonia. Weir of Glasgow²¹ reported a case of a man who was struck on the chest and developed pleurisy and finally phthisis. Some call this contusion tuberculosis.

Oliver²² has seen cases which suggest "a causal connection between injury and tuberculous lung disease." Other observers have been convinced that tuberculous meningitis can follow a head injury (Waibel,²³ Ehrnrooth²⁴). Traumatic tuberculosis of the breast and traumatic tuberculosis of the kidney have been described.

The relationship between injury and tuberculosis has been a subject of considerable debate in Germany since the promulgation of the workmen's compensation law in 1884. The new state insurance act must bring it to the front in England.

In the United States a horde of eager damage suit lawyers and a number of reluctant corporations are wrangling the

question into prominence. It behooves surgeons to study the matter, to think it over with care and to reach definite conclusions.

In the ensuing discussion I shall consider particularly tuberculous bones and joints. Joint tuberculosis is the condition in which the relation between trauma and tuberculosis seems to be closest.

Tubercle bacilli are particularly prone to take lodgment in and produce disease of cancellous tissue. The period of greatest liability is during the first decade of life, particularly during the first five years, though during the first year the disease is rare. Considerable more than half of the cases occur before the twentieth year. Many cases occur in persons much beyond the twentieth year, middle aged victims are not rarities and even the senile are not immune. Sir James Paget saw a case in a man of ninety-one. In the first decade the condition is about equally common in males and females. After the first decade up to the age of sixty it is most common in males. After sixty the disease is equally common in both sexes. Hereditary predisposition is often noted in children. It is found in at least twenty-five per cent of them. Inherited predisposition is far less commonly evident in adults. The prognosis in adults is decidedly worse than in children, suppuration is more apt to occur and sequestrum formation is a more usual consequence.

Howard Marsh says,²⁵ "Indeed recovery, when either the hip or the knee is attacked in patients between thirty and sixty-five, very rarely takes place." The prognosis is worse in males than in females. Death may be due to acute general tuberculosis, to tuberculosis of distant parts (lung, brain, genito-urinary organs, peritoneum), to exhaustion, or to lardaceous degeneration. Of W. Watson Cheyne's cases²⁶ only 4.4 per cent died of tuberculous disease and only 10.8 per cent suffered from phthisis or tuberculosis elsewhere.

In cases of bone and joint tuberculosis *demonstrable* tuberculosis of the lung is rare, in fact, the victims of supposedly primary tuberculosis disease of a bone or joint seldom develop active pulmonary tuberculosis.

Howard Marsh²⁵ says, "At the Alexandra Hospital, where there are always between sixty and seventy children under treatment for hip disease, and where the subsequent history of the case is, as far as possible, traced out, phthisis is so rare that sometimes a year passes without the development of more than two or three examples of it"

If tuberculous lesions exist in the lungs they are usually in "a comparatively dormant or recessive stage, and in the vast majority of instances do not progress, but clear up and disappear under treatment—and *pari passu*—with the improvement of the bone and the joint" (Woods Hutchinson²⁷)

Old foci, often latent or regressive, may exist in the lungs or in lymph-glands Cornet²⁸ tells us that out of 67 autopsies made by Orth in Gottingen, 53 showed distant foci but 14 cases were found free from any focus beyond the bone and joint.

Which joint is most commonly attacked? Most writers say the spine During the 15 years, from 1885-1899, 7841 cases were treated at the Hospital for Ruptured and Crippled in New York City Of these 3203 were instances of Pott's disease, 2230 of hip disease and the remaining 2408 cases comprised tuberculous disease of the other joints (quoted by Weeks²⁷) The lower suffer much more frequently than the upper extremities Age is certainly a factor in determining localization.

In early childhood hip disease is most common, but the knee runs it a close second The shoulder is seldom attacked during the first decade The hip seldom during the third decade and very seldom during the fourth decade

W Watson Cheyne²⁶ arranges "the various bones and joints in the following order of frequency of occurrence, from youth upward hip, knee, ankle and elbow, tarsus, fingers, spine, shoulder, wrist, ribs In order of frequency of occurrence during the first decade we have—hip, knee, spine, elbow, ankle, tarsus, fingers, wrist

Statistics show that a considerable and perhaps a very large per cent of all cases are preceded by injury and suggest that not a few cases in reality are directly determined by injury Some surgeons have assigned injury as a cause in 53

per cent of cases (C F. Taylor, quoted by Wilson and Rosenberger¹⁷) Others have restricted the number of traumatic cases to 10 per cent Whitman²⁹ combined the statistics of Koenig, Mikulicz, Bruns and Hildebrand, and thus obtained 3398 cases, 513 of which were described as traumatic

Ribera Y Sans³⁰ finds a record of antecedent trauma in 45 per cent of cases of tuberculosis of the larger joints

Koenig⁸ believed that distinct traumatism preceded the disease in 50 per cent of cases Voss³¹ set the percentage at twenty

Bosanquet³² says "I think we must put disease of the joints in a class by itself There is a considerable mass of evidence, that in some way or other injury does lead to tubercular arthritis" All statistics indicate that slight injuries are more often blamed than severe injuries It is not a dislocation of a joint which is thought to be causal, but a sprain of a joint or a contusion of a ligament It is ~~not~~ ^{not} a fracture of a bone but a bruise of the periosteum or a strain of an epiphysis Treves³³ says "Another feature in tuberculosis is the trifling nature of the irritant or lesion whereby the mischief may be in the first place localized"

Statistics show conclusively that recognized trauma often precedes the disease That trauma often precedes the disease does not prove that it causes the disease The sequence is not of necessity a consequence In order to prove that it is a consequence we must prove from known facts and justifiable deductions that an injury has a definite tendency to determine the development of the disease in a bone or in a joint.

All admit that a great number of cases arise without any record or sign of antecedent traumatism or preceding joint disease This is thoroughly proved by such recorded cases as the following A boy while in bed and under treatment for tuberculous disease of one hip developed the disease in the other hip

A person in apparently robust health may develop the disease Bonney²⁸ says "I have had occasion to note in a rather surprising number of cases the so-called idiopathic development of tuberculous processes in bones and joints among adult robust farmers and others accustomed to physical activity in the open air"

All acknowledge that if there is an existing active focus of

bone or joint tuberculosis an injury may aggravate the local condition and even disseminate the disease. An injury may prolong an illness, may convert a case tending to cure into a case tending to joint destruction or may convert a curable condition into a fatal malady.

The great importance all surgeons attach to rest in the treatment of tuberculous joints indicates the general conviction that even trivial traumatism may be detrimental or actually dangerous.

Forcible movement of a tuberculous joint is apt to be followed by articular destruction or the development of distant lesions. The patients who are not kept properly at rest are most apt to develop tuberculous meningitis or mixed infection of the joint.

All admit that a tuberculous lesion of a bone or joint may become latent and that such an arrest of the activity of a lesion is a long step on the road to cure. No one denies that an injury may light up into violent and perhaps destructive progress an area previously quiescent. Just this course of events is sometimes noted when a stiff joint containing latent foci of tuberculosis is subjected to forcible straightening. So far there has been no dispute. We have now reached the parting of the ways of opinion.

One school of surgical thought holds that osseous and articular tuberculosis is never primary, but is always secondary, and that when it is discovered after an injury, the injury was not in any sense causal of the disease, but merely aggravated a part already actively tuberculous or excited latent areas contained in the part into activity. In other words, it teaches that such a part was tuberculous before the accident and that the injury simply revealed an area of tuberculosis whose existence was previously unsuspected, or made more active an area of disease.

The other school holds that, while in most instances the disease is secondary in some it is certainly primary. It admits that in many cases the injury has merely aggravated a tuberculous lesion or awakened from dormancy a latent area, but

claims that in some cases injury is the direct determining cause of the disease. In such cases the part was free from all tubercles before the accident but quickly developed them afterwards. In such cases tubercle bacilli but not tubercles were in the part at the time of the accident or were brought there soon after it in the body fluids, such bacilli coming from some distant and probably unrecognized area of disease or having entered into the lymph and blood directly after ingestion, inhalation or inoculation. How can an injury be responsible for determining the development of tuberculosis of bone or joint?

Various bacteria by various routes are ever entering into the body fluids. If the individual is in sound health they seldom live long in the fluids. Unless the number introduced is inordinately great, the bacteria are peculiarly malignant, or the defensive apparatus of the body is impaired in efficiency, the bacteria do no harm and are soon killed. Some organisms and some spores may, of course, become latent (typhoid bacilli, pneumococci, staphylococci, spirochætes), but as a general rule bacteria are soon killed when the individual's health is good and when they reach no area of tissue damage.

Vital resistance may be lowered generally. A number of organisms might produce no effect on a healthy man yet produce disease in a person ill-nourished, weak, debilitated by alcohol, diabetes or Bright's disease, shaken by fear or depressed by shock.

Vital resistance may be lowered locally. This may be brought about by disease, as when bronchitis lowers pulmonary resistance—or by injury, as when a hæmatoma becomes the seat of suppuration. A local region of lowered or impaired resistance is called a *point of least resistance*.

Injury ruptures vessels. In a slight injury a few very small vessels are ruptured, trivial and transitory hyperæmia arises and little or no stasis follows. Stasis occurs after more severe injuries but even when stasis occurs the area of stasis is surrounded by a zone of hyperæmia. If blood contains bacteria, then hyperæmia, which is a condition in which more

blood passes through the part, means that more bacteria are brought to the part, and many of them pass out into the perivascular tissues through the ruptured vessels

Bacteria which enter the damaged tissues linger and tend to remain. Bacteria while lingering may pass out through the damaged vessel walls into the perivascular tissues. Hence an injury causes bacteria which are in the blood to linger in the region of damage and causes many of them to leave the vessels and enter as prisoners into the tissues. When bacteria linger they are dangerous—when they enter the tissues they are menaces. Instead of being carried rapidly by the part, as would have been the case had there been no injury, they make a prolonged stay in the damaged area, during the prolonged stay, which was invited by the traumatism, they have time to batter down cellular resistance by means of their bacterial poisons.

It is well known that bacteria, which when in a part but a brief time do no harm, produce disease if retained. Nacrede³⁴ says "Wegner and Grawitz have shown that the same number of germs, which when introduced into the peritoneal cavity will cause no trouble, because quickly removed by absorption, will produce a septic peritonitis if sterilized water be added to the pure culture. This so increases the bulk that a longer time is requisite for absorption, and hence a longer time is provided for the toxic substances to act locally, moreover, the inflammation usually starts at the point of original trauma, *i e*, the hypodermic needle puncture, the locus minoris resistentiae."

Many years ago Chauveau pointed out that if a vein were injected with putrid fluid and a testicle crushed, the gland became the seat of septic gangrene.

Kocher showed that if an animal is fed upon putrid meat disease of bone does not arise unless the part is subjected to traumatism. If a bone is injured osteomyelitis is very apt to occur.

Nacrede³⁴ says "The proof of these statements has been demonstrated by introducing into the circulation large numbers of the pyogenic cocci causative of osteomyelitis, whence

they quickly disappear by means such as have been already, or will be later, explained Repeat the inoculation, however, and then contuse or fracture a bone and promptly the microbes will be located and osteomyelitis will develop ”

Every surgeon is familiar with the fact that osteomyelitis without a wound frequently follows traumatism and does so when there was no antecedent purulent focus in the bone He is accustomed to search for a distant focus from which the cocci might have come Sometimes he finds no such atrium of infection, at other times he finds a pyogenic focus in the pleura, the lung, the ear, the mouth, the tonsil, the prostate or the skin

Nancrede ³¹ says, “ A carious tooth, the lesions inflicted on the gums by the tooth-brush or tooth-pick, burns, scalds and damages of the buccal mucous membrane caused by the teeth, lesions of the nasal passages, and recently healed wounds, may any of them be the entrance point of microorganisms productive even of fatal pyemia ”

The surgeon never doubts that the bone injury determined the origin of the osteomyelitis, not by causing the creation of pyogenic bacteria, but by creating a point of least resistance, where organisms which previously passed through linger or lodge Because of the trauma organisms which would have proved futile for harm and would have gone to rapid destruction live, multiply and produce disease

In 21 of Hahn's 41 cases of vertebral osteomyelitis there had been antecedent traumatism and in six of these cases Hahn regarded traumatism as certainly the cause

Acute infectious arthritis of the hip is usually determined by injury The colon bacillus does not harm the appendix unless that part is congested or obstructed, kinked, twisted or bruised When resistance is thus lowered the colon bacillus causes appendicitis

In typhoid the germs enter the blood and may remain there for some time They tend to lie latent perhaps for a very long time in bone-marrow and yet may never cause disease Traumatism will be followed by typhoid osteomyelitis Trauma

during or after typhoid may be responsible for typhoid spine. Traumatism of a bone in a syphilitic is followed by periostitis due to spirochætes. It is well known that empyema may follow contusion of the chest. That pyogenic cocci and various other microorganisms act in this way is not disputed. Is it unfair to assert that tubercle bacilli act in exactly the same way? They are so widely distributed, are so frequently taken into the body and are so hard to kill it would seem odd if they did not.

In fact, tubercle bacilli *do* act in the same way. They may enter blood and lymph from an active focus of disease, from a passive focus of disease, or directly by inhalation, ingestion, or inoculation without inducing disease at the point of entrance and when no known focus of disease exists. Latent lesions are most common in the bronchial and mesenteric glands, they tend to cure but may be raised into activity by some bodily disease or some injury. Even when not so goaded they may from time to time give bacteria to the system. We can seldom know that a latent lesion exists. Such a lesion is probably tuberculosis advancing toward cure.

Ravenel, Orth and others have shown that tubercle bacilli may pass through the wall of a normal intestine without causing any tell-tale lesion at the point of passage and may produce tuberculosis in the mesenteric lymph-glands or may remain latent in the nodes for a brief or for a considerable period of time. Bacilli may lie latent in glands even when the glands are not diseased. They are very tenacious of life. The fatty material or wax of the bacilli "has the faculty of resisting, in a special manner, the influence of the digestive juices, of the phagocytes, the cells which exterminate dangerous microbes, and are therefore defenders of the animal organism" ²⁷

Living bacilli have been found in the fæces of apparently healthy subjects. "It would seem rational to believe that the fæces, at least, would contain occasional tubercle bacilli carried into the mouth with the food or air, and thence into the digestive tract without infecting the patient" (Wilson and Rosenberger ²⁷). Rosenberger has knowledge "of at least two

cases in which we have found bacilli in the fæces, and in which, at autopsy, no macroscopical lesions of tuberculosis could be detected throughout the body. This does not mean, of course, that the patient may not have had an actual infection by tubercle bacilli at the time of examination of the fæces and the discovery of the bacilli " 27

Various observers tell us that at ordinary temperatures the bacilli will live and remain virulent in water for several months (Rosenau ²⁷). They will live much longer and freely travel in blood and lymph and may never induce tuberculous lesions.

That they can live in blood has been proved. They can enter the blood from the food by way of the lymph taken up from the intestines. They may enter the lymph from inoculation and perhaps from inhalation, and from the lymph they enter the blood. They may enter the blood from an active or latent focus of disease. If soup containing tubercle bacilli is given to animals the bacteria reach the blood of the heart within five hours (Besanti and Panisset).

In what Landouzy ²⁷ called typhobacillosis, the blood contains tubercle bacilli in numbers. They produce a septicæmic condition with positive symptoms, yet there may be no tuberculous lesion. If blood drawn from the vein of such a patient be injected into a guinea-pig the animal will develop tuberculosis.

The blood, even in a person devoid of any tuberculous lesion, must at times contain tubercle bacilli, which may linger long before dying, which may get into a gland or some other structure, there to remain latent or to induce disease. Tubercle bacilli have an affinity for special parts and tend to settle out into them (cancellous tissue of bone, lung, kidney, lymph-glands, and serous membranes). An injury tends strongly to localize bacteria. This is especially true of injury to certain bones. The lung is particularly predisposed by catarrh. The bone is particularly predisposed by trauma.

Slight injuries predispose much more decidedly than severe injuries. Volkmann called attention to this years ago. Rose

and Carless³⁵ say that the bacilli find "a suitable breeding ground" in "bones and joints in a state of congestion resulting from slight and overlooked injuries" When a few small vessels are ruptured or thrombosed, when trivial hyperæmia arises and the vital activity of an area of cells is lowered, and when the bacilli are caught in the area, they will be apt to multiply and cause disease In such a trivial injury says Nancrede,³⁴ "The hyperæmia is too limited to admit of the prompt arrival and accumulation of phagocytes and alexins" A severe injury "is productive of such cell-proliferation that it will hold in abeyance the pathogenic action of the bacilli which might reach the seat of injury with the extravasated blood" (Senn¹⁹) After a severe injury the more prolonged hyperæmia permits of a prompt arrival of phagocytes and alexins In a severe injury retardation and stasis become marked and in this condition phagocytes in numbers and germicidal materials pass into the perivascular tissues Traumatic cases are commoner in adults than in children Traumatic cases give a worse prognosis than non-traumatic cases Disorganization is more common, mixed infection is more usual and dissemination is more apt to take place

In a case of tuberculous arthritis, if the reality of the accident is proved, if from the time of the accident there continued to be some pain and stiffness in the part and if the symptoms suggestive of tuberculosis arise at a period not over three months from the accident we are justified in regarding the trauma as having been causal (Bosanquet³²)

When a surgeon suspects the existence of a tuberculous joint he should always have an X-ray picture taken Changes will be visible when the bacilli have attacked the blood-vessels and have produced nodules which destroy the medullary tissue

In young children when the extremities of the bone are cartilaginous the X-rays will not be nearly so valuable in aiding early diagnosis as they are in adults Whenever bone destruc-

tion has occurred the X-rays will show disease. The significance of bone changes should be interpreted by an expert.

The fact that not very unusually joints when skiagraphed very soon after an accident show no trace of tubercle and yet in a few weeks or months have become obviously tuberculous, suggests, though it does not prove, that such joints contained no old foci of disease, that the injury did more than merely aggravate an active focus or rouse a dormant area and was in reality the determining cause of the joint disease. In every case of articular tuberculosis a surgeon seeks carefully for a primary focus. He may find it in a gland, lung, in the abdomen or in another articulation. In very many cases he cannot find it. In such a case there may be no other lesion or there may be a latent area. If there is a latent area it is giving no symptoms and is probably on the road to cure. An unrecognizable latent area may be raised into activity by a traumatism inflicted at the same time as the articular injury, by cold, by shock, by exhaustion, by fear, by confinement to the house, or by the development of some complicating disease. Among the objections raised to the view that traumatism may be a determining cause of articular tuberculosis are the following:

1. That a slight injury cannot be responsible when a severe injury is not. Wilson and Rosenberger¹⁷ say "It is inconceivable that lesser injuries should do what greater injuries fail to do." Nevertheless, the statement that a slight injury does what a severe injury fails to do is true of typhoid disease of bones and joints—of osseous gummata—and of many cases of pyogenic osteomyelitis.

Bone sarcoma is more common after contusions than after fractures.

Few dispute that tuberculous thecitis may follow injury. In such a case the injury is more often trivial than violent. Why should the occurrence be inconceivable in a tuberculous bone or joint when exactly the same thing is noted, and when it is accepted in tuberculous thecitis and various other conditions? As previously stated a severe injury promptly brings quantities of phagocytes and alexins, establishes stasis which

is antagonistic to tubercle, and causes active cell proliferation

A mild injury produces limited hyperæmia. Few phagocytes are available and little alexin arrives, there is little or no protective stasis and the tissue defences are not aroused to exert an effort at self protection

2 Because the lower extremities suffer most often from tuberculosis but are least often injured, it is urged that injury cannot be causal. As a matter of fact, the larger joints are in the lower extremities, the larger joints are apt to suffer from slight injuries, and the larger joints are most often the seat of tuberculosis after injury

The knee is the most common seat of supposed traumatic tuberculosis

In some other diseases of bone and joint the same predilection is shown for the lower extremities

The femur and tibia are most prone to osteomyelitis and I know of no denial that traumatism may be the determining cause of this disease. The same is true of typhoid disease of the bones and joints. Syphilis seldom attacks the smaller bones, but is notably common in the tibia

3 That there are many injuries of bones and joints but comparatively few cases of tuberculous disease is looked upon by some as a conclusive fact against a traumatic origin of that disease. The argument is merely equivalent to saying that there are many winds but comparatively few shipwrecks, hence wind cannot cause a wreck—that there are many fogs but few railroad collisions, hence fog cannot be responsible for collision—that there are many falls but few fractures, hence a fall cannot break a bone

4 The way nature protects the joints is regarded by some as indicating that slight traumatisms are unusual, for example, the knee. "In falling and striking the knee the tuberosity of the tibia receives the impact, while the patella and the entire knee escape direct injury, and yet the condyles of the femur are far more frequently the original site of tuberculosis than the tibia" (Wilson and Rosenberger¹⁷) There are at

least three answers to this statement. In the young strain of an epiphysis is a common cause and the femoral epiphysis may be strained when the tibia is contused. Muscular or ligamentous strain may be responsible, as it is known to be in typhoid spine.

The impairment of the normal activity of the part due to the injury is responsible for trauma during functionation. This is known as "functional trauma," and functional trauma may be causal as truly as strain or contusion from the accident.

5 Some assert that as mechanical stasis tends to cure tuberculosis and as injury causes stasis, injury could not determine tuberculosis. Those who put forth this assertion should go to the logical conclusion and claim that injury of a tuberculous part would cure the disease. As a matter of fact, stasis produced by the rubber band (Bier's method) is not identical with inflammatory stasis. Further, in very slight injuries there is no stasis or very slight and temporary stasis, and it is very slight injuries which are most often to blame.

I believe that it is as certain as many things medical can be that traumatism is often a determining cause of bone and articular tuberculosis and sometimes of tuberculosis in other regions. This view is held by numbers of able and eminent clinicians and should be recognized by all courts of law.

I have seen many cases which I regard as traumatic tuberculosis of bones and of joints, and a number of cases of traumatic tuberculosis of tendon sheaths. A striking case of bone tuberculosis occurring in my practice was disease of the sacro-iliac joint arising in a sturdy miner after a wrench. There was never any evidence of any other focus. Cure followed operation.

I have seen a number of cases of traumatic tuberculosis in the knee, foot, and wrist and several in the hip. I have seen tuberculosis of the inguinal glands after a kick, tuberculosis of the epididymis after a bruise, tuberculosis of the kidney after contusion of that organ, and tuberculosis of the mammary gland after a blow.

A fireman in first class physical condition fell from a roof

and fractured several ribs on the right side. Pleuritis arose, traumatic pneumonia with hemorrhage developed, and later the man died of pulmonary tuberculosis. A post mortem made by the coroner's physician disclosed the fact that the oldest pulmonary lesions were near the bruise and directly under the adherent pleura and the injured ribs. The man's family was given a pension, and in the Philadelphia Fire Department a pension is paid only when death is regarded as having been directly due to an injury.

To deny the possibility of traumatic tuberculosis is to deny many of the truths of pathology and some of the plainest lessons of clinical surgery.

The possibility of traumatic tuberculosis is a necessary deduction from acknowledged facts. To affirm it seems consistent, reasonable and, in fact, unavoidable even though the affirmation outrages the sensibilities and stirs the indignation of numerous corporation attorneys, who, in the words of Milton—"Ground their purposes not on the prudent and heavenly contemplation of justice and equity, but on the promising and pleasing thoughts of litigious terms, fat contentions and flowing fees."

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UNCOMPLICATED TUBERCULOUS FOCI IN BONES AND THEIR TREATMENT.

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THE term, uncomplicated tuberculosis bone foci, has reference to those cases in which the focus exists (*a*) as an incipient lesion, but sufficiently advanced to cause symptoms, and suggest diagnosis, (*b*) as a lesion which has resumed activity after a period of quiescence, with a renewal of characteristic symptoms *In neither case has it become the seat of a mixed infection, nor has it invaded the adjacent joint*

The promise of the orthopædist in dealing with lesions of this type, is based upon the belief that conservatism is his best if not only reliance

I have always been skeptical regarding permanent cure of bone tuberculosis by orthopædic measures, rest, fixation, traction and general systemic measures Later observation and experience have confirmed my earlier belief In a word, I do not accept the doctrine of the final efficiency of conservatism, and have been in search of a more rational solution of a much mooted question through early, radical interference

In a paper upon "The Operative Treatment of Hip-joint Disease,"¹ I said, "In the entire category of surgical experiences, there is nothing more pathetic and disheartening than the humiliating failures which have followed prolonged, painstaking efforts of skilful men in this department of surgery"

John L Porter of Chicago, writing from the stand-point of the orthopædist, says,² "I doubt if there is any surgical disease which has been the subject of so much controversy, or

¹ Am Journal Medical Sciences, July, 1905

² Surg, Gynecol and Obstetrics, 1913, vol xvi, p 334

which has been subjected to such wide diversity of methods in treatment, as tuberculosis of joints, but it seems to me that each year brings a little more unanimity of opinion, that we find ourselves discarding suggestions of doubtful value and are treating each case in accordance with its own indications rather than by a method of fixed routine "

He maintains (*a*) that tuberculosis of joints in normal persons is a self-limited disease, (*b*) that in untreated cases the results are deformity and disability, (*c*) that the degree of deformity and disability depends upon the extent of time and duration of treatment

As to the last factor he says that out of many hundreds of patients a few were well in one year, more required three years, and a larger number from three to five years. He makes no mention of unsatisfactory results nor mortality rate

Speaking of early operation, as advocated by Ely and that which I have suggested, he says, "While these may be of value in certain selected cases, it is doubtful if they are advisable as routine methods "

Very significant are the observations of Chas F Painter of Boston³ Painter asserts that a tuberculous lesion is a constant menace to its possessor long after an apparent cure has been effected. He frankly questions the correctness of diagnosis in certain cases in the statement that many of the best results in cured cases are probably not tuberculosis

He dwells upon the fact that tubercle bacilli live indefinitely in an encapsulated area, and fears recrudescence after the lapse of a variable interval. He states that during the past eight years 130 cases of "Pott's" and 180 cases of hip-joint disease were treated at the Kearney Hospital Clinic. A very considerable number of these cases came for secondary treatment after an interval of quiescence

To these Painter applies the term "malignant" (recurring), and endorses the statement of Barker and Croft that cures reported in orthopædic statistics are wholly unreliable

³Trans of Am Orthopedic Assn, 1902, "Malignancy of Joint Tuberculosis "

He warns patients who are cured by ordinary methods of the tendency to recurrence and insists that abatement of symptoms is in no sense an assurance against later trouble

He expresses the opinion "that exploratory interference, with a view to removal of isolated foci in children is often advisable, and is to be urged in a majority of the recrudescences if seen early"

These views regarding the clinical history of bone and joint tuberculosis are fully in accord with my own Repeated reference by many orthopædic writers to the protracted struggle for quiescence and apparent cure is of extreme interest, and in my opinion suggests to the general surgeon the propriety of assuming jurisdiction in a field uniformly conceded to the orthopædic specialist

Latency as applied to bone tuberculosis, as to other surgical conditions, is a word to juggle with, and to my mind is little short of a misnomer There seems to be a close analogy between tuberculous foci and a considerable pathological group, such as gall-bladder disease, chronic appendicitis and renal lithiasis.

No fact is better established than that alleged latency in this latter group is based upon error and is perniciously misleading That insidiously progressive and harmful changes occur during a period of alleged latency in gall-bladder disease is beyond question

To leave an accessible tuberculous bone focus, whether isolated or not, to smoulder until provoked to renewed activity at a later period is without justification, and seems to do violence to surgical principles Certainly such a course in the presence of an osteomyelitis due to ordinary pathogens would be reprehensible Can it be otherwise than true that thorough removal of the focus and surrounding tissue is as logical for tuberculous as for ordinary osteomyelitis?

Brackett of Boston, editorially in the *Am Jour of Orthopædic Surgery*, says, "It is not to be expected that surgery, meaning operative surgery, will replace conservatism, but it is to be hoped that it will shorten the long and disastrous

periods of conservative methods, disastrous because of the almost waste of time in years of disability and the danger accruing to general health”

It is a matter of regret that so eminent an authority did not further elucidate his plan and explain by what technic he hopes to avoid the “almost waste of time” and prevent some of the disastrous consequences of pure conservatism

It is a fact that resort to operative treatment has rarely been looked upon with favor during that interesting and critical period which goes before extensive invasion and joint destruction. On the contrary, radical treatment has been appealed to after conservatism has failed and when grave complications have rendered desperate measures inevitable

The propriety of operative interference, with reference to radical cure during incipency, depends upon two factors (a) Early diagnosis, (b) accurate localization of the focus

The former requirement is fundamental. The clinical history and symptom complex, together with tuberculin reactions and local joint conditions will furnish sufficient data on which to base a tentative opinion. Buxton⁴ says emphatically “The easier the diagnosis, the worse the prognosis. This applies more aptly to the treatment of this condition than to any other human ailment”

The possibility of lues must be carefully considered, and each case must be studied with reference to the acute conditions due to ordinary pathogens

Localization in very early cases is a matter of some difficulty and may be impossible. Primarily, we know that in those bones most commonly affected, certain areas are a favorite seat of implantation. Persistent pain and tenderness over a circumscribed area are significant as pointing to the seat of disease. With fair assurance that an accessible focus lies beneath the cortex within reasonable limitations, the operator need not be too precise as to its exact anatomical relations

⁴ Va Med Semi-Monthly, November, 1913

But final localization in obscure cases must be deferred until the focus can be identified in the radiogram

I wish to insist that in the acute, fulminating cases delay for any purpose is extremely hazardous, and that to this type, if to no other, early incision and evacuation offers peculiar advantages

The objects to be obtained by early, direct interference are (a) Permanent cure by elimination of the focus, (b) reduction of time of treatment from years to months, (c) prevention of complications, such as abscess formation, mixed infection, disintegration of bone and joint structures, crippling deformity and loss of function, (d) avoidance of systemic invasion and loss of life

Operative technic is usually simple. Every exaction in the interest of asepticity must be observed. The most available extra-articular route is to be chosen. A rather liberal incision is carried to and through the periosteum. A sufficient area of bone is exposed over the suspected part. With a trephine or chisel the cortex is removed until the opening affords easy access to the marrow. With a strong, sharp curette the end of the bone is converted into a shell-like cavity, whose dimensions must depend upon the judgment and tactile sense of the operator.

The propriety of interfering with the epiphyseal cartilage has been questioned, particularly in the very young. My opinion is that if the disease has extended from its original location across this cartilage not much respect need be paid to it, if in the remote side it will naturally be preserved. Utmost care must be exercised to avoid perforation of the cortex so as to communicate with the synovial cavity.

The resulting chamber may be dealt with variously.

Sherman of San Francisco, after a liberal application of pure carbolic acid and alcohol, fills the cavity with normal salt solution, and closes the wound in tiers. In a series of uncomplicated cases, he has not had a failure and he commends the method strongly.

I have generally depended upon camphor phenol gauze

packing (phenol one part, gum camphor three parts). The gauze is wrung dry and closely packed into the cavity. A few days later the amount of gauze is lessened and a little later is discarded. Such wounds heal rapidly and all discharge ceases in less than a fortnight under an aseptic dressing.

The great value of camphor phenol as an antiseptic is in the presence of infections, and as a safeguard in clean, open wounds seems not to be generally understood.

After removal of the initial dressing the cavity is usually free from blood, and can be filled with Beck's paste or the Mosetig-Moorhof wax. The wound may then be closed in the usual manner and fixation secured by a rather loosely applied plaster-of-Paris dressing.

I am able to report sixteen cases in which I have pursued the plan herein described, as follows: upper end of femur, three, lower end of femur, five, upper end of tibia, four, internal malleolus, two, lower end of radius, two.

In three of the operations upon the condyles of the femur, wound infection was encountered and convalescence delayed. In no case was the end result unsatisfactory, either from the stand-point of serious loss of function or of recrudescence. The mixed infections were encountered during my earlier experiences, when technic was far from perfect. The history of these cases is in marked contrast to manifold experiences had in late suppurating conditions.

I have been deeply impressed throughout with the fact that the sooner operative treatment was undertaken after diagnosis and localization, the simpler was the procedure, the shorter the time of convalescence and less was the degree of loss of function.

Attention is especially called to the three hip-joint cases noted above, in which my interest has centred, and which are already in the literature.⁵

Following the suggestion of Macnamara,⁶ I proceeded to

⁵ *Am Jour Med Sciences*, July, 1905, Surgery, Gynecology and Obstetrics, April, 1906, Surgery, Gynecology and Obstetrics, October, 1911.

⁶ *Disease of Bones and Joints*, 1881.

tunnel into the neck of the femur, through a trephine opening below the great trochanter, thereby removing most of the soft content of the neck. In one instance it was necessary to repeat the operation after a lapse of two weeks. At this time the epiphyseal cartilage was perforated, though but a small part of the head of the bone was removed.

The diagnosis in the three cases which constitute my series has been sharply questioned.

Heredity in every instance pointed to tuberculosis, and in one (a fulminating case) the patient suffered from a tuberculous lesion in the apex. The clinical history was most convincing. These patients are accessible and have been closely observed. All were well without recrudescence after a lapse of eleven, ten and eight years respectively. The average time of treatment about six months. One patient left the hospital in one month and was reported well in two months.

The functional results are as follows. One has nearly one inch shortening with motion through an angle of 35 degrees. This patient left my care permanently at the end of one month. It is fair to assume that the loss of joint function could have been measurably lessened by careful attention subsequent to the operation.

The second case has one-half inch shortening with nearly perfect function.

The third case has neither shortening nor loss of function.

Henning Waldenstrom of Stockholm,⁷ with a large experience, is an ardent advocate of extracapsular removal of the focus. He has devised what he calls "a prophylactic operation." With a slightly different technic he accomplishes a purpose similar to my own.

Sherman's experience in this field leads him to justify the method, but he insists that a focus must be localized within narrow limitations before attempting relief. In at least four cases he has succeeded admirably.

⁷ Monograph "Tuberculosis of the Hip in Children," 1910

FRONTAL SINUS SUPPURATION.*

THE ESTABLISHMENT OF PERMANENT NASAL DRAINAGE, THE CLOSURE OF
EXTERNAL FISTULÆ, EPIDERMIZATION OF SINUS

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THE logical treatment of most pathologic conditions is based upon an understanding of the cause. The condition with which we have to deal is that of chronic suppuration in a natural bony cavity which has a single small opening. We have to contend with changes produced by bacterial action and by mechanical obstruction.

PATHOLOGY—I *Acute catarrhal inflammation* Following an attack of acute coryza, it is very common to observe an acute inflammation in the accessory sinuses, of which the frontal sinus is no exception. Its course is generally moderate and it is followed by complete resolution. If the ostium becomes occluded, an abscess or acute empyema may follow. This complication is more serious and the pus must escape sooner or later. This may be relieved by surgical intervention, or some wall of the sinus may ulcerate through, or relief may be spontaneous through the natural opening. Chronic suppuration is not an uncommon sequence.

2 *Chronic catarrhal inflammation* This is a comparatively common condition, manifested clinically by the presence of pus in the middle meatus, together with certain subjective, and sometimes other objective, signs which it is not the aim of this paper to consider. The pathologic changes are of great importance. The mucous membrane of the sinus undergoes the changes common to any mucous membrane which is the seat of a chronic inflammation. It becomes thickened from œdema and connective tissue proliferation, the surface is irregular and sometimes ulcerating, and there may be polypoid growths sufficient to fill and cause pressure within the sinus.

* Read before the American Surgical Association, April, 1914

The ciliated epithelium is often destroyed. The ostium is more or less obstructed so as to impair drainage permanently. In some instances the periosteum and bone may be involved but such is the exceptional result.

The subsequent course will depend upon the degree and length of time of the obstruction and also upon the nature of the secondary changes in the mucous membrane.

TREATMENT—The problem of the treatment of suppuration in any cavity depends upon the nature of the anatomic and pathologic conditions. Let us consider the general underlying principles which govern the treatment of suppuration in the various kinds of cavities.

1 *In Soft Tissues*—If pus is evacuated from an abscess or cellulitis and efficient drainage is provided, the abscess wall collapses, the cavity becomes smaller and gradually closes from the bottom and, in a comparatively short time, the parts are healed. The closing progresses from the depths to the surface. This is what happens even in the closing of suppurating cavities within the abdomen, and we all know to our discomfort what it means to have the opening in the abdominal wall close before the deeper parts of the suppurating cavity are practically obliterated.

2 *Suppuration in Cavities with Partially Rigid Walls*—Suppuration in the pleural cavity—empyema—is a type. The cavity is made by the pus crowding the lung. In the cases operated upon early with the establishment of suitable drainage, maintained continuously until the lung gradually expands and thus obliterates the cavity, a cure is obtained.

In the chronic cases excessive adhesions and connective tissue formation tend to prevent lung expansion. Such cases may fail to heal, although the drainage be ample, because a large cavity with suppurating walls persists. In rare cases, under such conditions, relief may be afforded by decortication or better by causing the rigid and almost unyielding chest wall to sink in to meet the lung and thus obliterate the cavity. This is accomplished by extensive rib excision. Hence, suppuration in the pleural cavity will persist until the cavity is oblit-

erated by one means or another but, if not obliterated, the subsequent course will depend upon the facility with which it drains. If the opening becomes occluded too early, acute symptoms follow, if it remains patent, the discharge continues indefinitely, varying in amount more or less according to the size of the cavity and the freedom of drainage.

3 *Suppuration in Bony Cavities with Entirely Rigid Walls*

—(a) Unnatural cavities, for example, in osteomyelitis of long bones. Relief is obtained only after sequestra have been removed and the cavity obliterated by granulation tissue— healing from the bottom. In the shaft of long bones the healing may take place without much subsequent scar or bony defect, but at an enlarged extremity, as, for example, the upper end of the tibia, the extensive loss of cancellated structure may leave only the cortex as a rigid wall of a chronic suppurating cavity. Destruction of this cortex, in order to obliterate such a cavity, would mean a fractured leg, which of course would be an unjustifiable procedure. Some cavities of this sort never heal, some become epidermized after a very long period, leaving a more or less deep depression, and, in rare cases, a cavity may be obliterated by some sort of graft. Much of the cell structure of the mastoid, when inflamed, presents the same situation. In all the above examples of suppurating cavities, healing takes place only by obliteration of the cavity.

(b) *Suppuration in natural bony cavities*. Such cavities occur only in the head, they are lined with mucous membrane and communicate externally through the ear or nose. Frequently, they are the site of chronic inflammation. Relief may be obtained by efficient drainage, resulting in complete resolution, or by obliteration of the cavity, or, in a measure, by a combination of these methods, in cases where it is either unwise or impossible to entirely obliterate the cavity.

The frontal sinus is a natural cavity with rigid bony walls and the problem of treatment of suppuration depends upon anatomic and pathologic conditions. The chances of cure and differences in cosmetic effects vary according to the mode of treatment.

Let us now consider some of the methods used for the treatment of these cases

Acute Catarrhal Inflammation of the Frontal Sinus —This paper concerns chiefly the treatment of the more obstinate cases of chronic suppuration. In passing, however, let it be said that various degrees of acute inflammation are very common, but most of these resolve spontaneously in the course of a few days without particular treatment. Very occasionally, comparatively speaking, the ostium becomes occluded and abscess with perforating of a sinus wall results, but very often, after repeated exacerbations, the process becomes chronic and some sort of surgical interference is necessary.

Let us review briefly the principles underlying the chief operative measures for the relief of chronic frontal sinus suppuration. These may be classified as (1) intranasal operations and (2) extranasal operations.

(1) *Intranasal Operations* —Certain anatomic features will be discussed in detail later, but, suffice it to say here, that the sinus drains through a comparatively small opening in its floor in close proximity to several anterior ethmoid cells and the extreme upper front portion of the middle turbinate bone. Attempts to cure all chronic cases should be made first by intranasal methods. These consist in the removal of the anterior portion of the middle turbinate and the breaking up of as many anterior cells as possible, the object being to establish free drainage. Many patients obtain satisfactory relief by this means. Attempts may be made to probe the sinus but there is always some doubt as to the success of such attempts, for reasons so frequently recorded by anatomists and clinicians. More radical intranasal methods are recommended and practised by some. These include the operations which aim to enlarge the frontal opening by means of burr drills and different types of raspatories, aided by the use of shields of different shapes and other guides to prevent injury to the bone posterior to the ostium. It is possible to probe some sinuses and then to enlarge the bony opening by these methods and obtain beneficial results. On the other hand, it is perfectly

obvious in the greater number of cases that the probe is not positively in the sinus and that the operator has absolutely no means of knowing the bony relations and, therefore, can never be reasonably sure of just what he is doing. The distances around the ostium are so short, the portions of bone to be removed so thick, and the bone protecting the dangerous structures so thin, that I am firmly convinced that what amounts to "blind operating" is unwise, particularly when there are other methods which allow of a certain amount of vision. These more radical intranasal methods involve far greater risk to life, for reasons so often detailed by others, than the external operations in which we are better able to see just what is being done. Furthermore, I believe that all very radical operations for the cure of chronic suppuration are serious and should not be looked upon lightly. The parts are so small and the importance of removing all bone around the ostium so great, that I believe it can be accomplished only by the aid of vision, which ensures both precision and safety. Hence, to summarize, I would say that, primarily, in all cases the front of the middle turbinate and all cells and growths in the vicinity lying below the ostium should be carefully removed and then some weeks allowed to elapse in the hope that a satisfactory cure will follow. Although I think that the complete removal of the nasal floor of the sinus is the essential factor in the cure of these cases, I believe that the nasal route is inefficient and unnecessarily dangerous even in skilled hands.

(2) *Extranasal Operations*—The object of all operations is to cure the condition. There are two general types of extranasal methods, one aims to enlarge the natural opening and the other is a destructive method which aims to obliterate the sinus. Some methods tend to combine these principles. It seems to me that most of the very radical methods simply offer different degrees of exposure of the sinus, and, if the sinus is one that cannot be obliterated, a cure does not follow because the essential cause is not removed. In other words, the removal of large portions of the facial and orbital walls does not affect the size of the region of the ostium where the

opportunity for enlargement is none too good at best. However, this general removal of surfaces does do good and in many cases is followed by satisfactory healing because the sinus is practically obliterated or made so small that it is no longer troublesome, but the cosmetic results are unsatisfactory.

(a) *Operations to reestablish drainage* The Ogston-Luc operation, described by the former in 1884 and modified by the latter in 1894, is essentially a curetting of the cells around and below the ostium, chiefly through an opening in the facial wall. Modifications consist in the use or not of different types of temporary nasal or external drainage, but, finally, events must be left to take a natural course. Relief might follow but failures have been so common that more radical measures were adopted. Failure was, of course, due to recurrence of obstruction at the ostium, sometimes followed by an external fistula. Although the Ogston-Luc operation has been given up largely for the more destructive methods, its conception was in the right direction so far as combining a cure and good cosmetic results is concerned.

In this group we have also various osteoplastic resections combined with curetting around the ostium, one of which the writer devised and published in 1898. I believe these are unwise because it is not good technic to attempt plastic bone surgery around such suppurating cavities. The risk of spreading infection is great, the flap of bone is prone to necrosis because of the lack of nutrition, and its loss is followed by unnecessary deformity.

(b) *Efforts to obliterate the sinus* Most of these operations combine a certain amount of curetting of ethmoid cells with that of the whole sinus, some do not disturb the floor of the sinus.

In 1894, Kunt suggested the removal of the facial wall so as to allow the skin to come in contact with the cerebral wall of the sinus, this would fail to obliterate a deep sinus.

Jansen's plan, formulated in 1893, was to remove the orbital floor, this would not obliterate a high sinus.

In 1898, Riedel resected both facial and orbital walls, this

was more likely to obliterate the sinus, but the deformity is very marked

In these attempts at obliteration, obstinate and troublesome pockets of pus persist in distal portions of large sinuses, so that suppuration and fistulæ continue

In 1902, Killian suggested the resection of the orbital and facial walls, including a considerable portion of the nasal process of the superior maxilla, but left a bridge of bone along the supra-orbital arch so as to lessen the subsequent deformity. He includes also a thorough curetting of the neighboring cells and removal of a portion of the nasal crest of the frontal bone.

These four methods represent the general types of oblitative operations and various modifications of each have been devised. The Killian is the most radical and probably gives the greater percentage of cures. Failures are not uncommon and even here eventual deformity and occasional sequelæ persist. In the Killian method, if the sinus cannot be obliterated, the avenue of escape of exudate into the nose is narrowed because the soft parts fall in and are drawn in by scar tissue at the level of the site of the ostium because the support given by the upper portions of the nasal process and lachrymal bones is gone. Although one sees it stated frequently that the Killian operation is the final word in frontal sinus operations, still the results demonstrate that there is much more to be desired.

Some General Considerations —The essential cause of continued frontal sinus suppuration is inadequate drainage which, in turn, may be followed by aggravating complications. Relief may be obtained by obliterating the sinus, or by establishing adequate drainage. The former cannot always be accomplished and it invariably results in objectionable deformity. On the other hand, it is not easy to obtain the desired amount of drainage. We must decide in each case, considering all the evidence at hand, whether we shall endeavor to obliterate the sinus or provide adequate drainage. The larger the sinus, the more difficult will be the task of obliterating it, and the more objectionable will be the deformity. On the other hand, the larger sinus is more easily drained and open to subsequent in-

transnasal treatment, which is required after most sinus operations. If we can obtain a cure without bony deformity, this of course is desirable. In a general way, the larger the sinus the more trouble it causes, because of its increased area for suppuration and its greater capacity for granulations and polyp. The technic to be described seems to me to be particularly indicated when the sinus is large, when both sinuses are affected, or when an external fistula is present, and it should afford relief also after other methods have failed. The method avoids injury to the orbital contents, such as result in cellulitis, double vision, and inflammation of the lachrymal sac. It ensures easy access for the subsequent treatment of granulations, while the distal narrow angles and borders tend to become obliterated by scar tissue and the size of the new ostium, which can readily be kept open, prevents the retention of exudate until, finally, the remaining walls of the sinus cease to give rise to exudate and become covered with smooth scar tissue or mucous membrane. The ostium can be made actually as large as the anatomy will allow while the natural bony outline is preserved. If we are striving to get drainage, then I believe that the principle of the Killian and such operations is at fault, because, by the removal of the upper portion of the lachrymal bone, the nasal process, and the immediate adjacent part of the frontal bone, we take away bony support just where we need it and thereby allow the soft parts to fall in and be drawn in by contraction at a point where every fraction of an inch is most valuable.

The various external operations differ chiefly in the method of approach to the sinus, but the real issue is that of efficient drainage.

Hence, if the intranasal efforts for drainage described above fail, I believe we should attempt to establish it by the use of a method which is a combination of both the internal and external routes.

ANATOMY—In considering the anatomy of the frontal sinus, the description will be limited to the structure and topography of those portions which are of practical importance.

in carrying out the technic of operation to be described later. Some years ago the writer published in detail the descriptive anatomy of this sinus and the anterior ethmoid cells (see Frontal Sinus and also Turbinate articles), but the following features are more particularly of operative importance

All of the sinus is in the frontal bone. The sinuses vary in shape and size but, in a general way, present three surfaces and a base. The inner portion of the base and the posterior angle are situated above the extreme anterior portion of the nasal cavity and some of the anterior ethmoid cells (Figs 9 and 17). The *posterior* or cerebral wall is in front of the frontal lobe of the brain and, although comparatively thin, the bone is dense in structure and not easily injured. This wall should be carefully avoided. The *anterior* or facial wall is the thickest, is more or less cancellated, and is the avenue of approach in most of the so-called external operations. Its extent, thickness and outline vary according to the size and shape of the sinus. The usual exploratory opening is made a little above the extremity of the nasal process of the superior maxilla (Figs 1, 2 and 19), because the smallest sinus occupies this position. Very thick bone at this point is an indication that the sinus must be very small and does not rise to this level. For practical purposes such a sinus amounts to no more than an ethmoid cell and, of itself, could not be of much pathologic importance.

The *floor of the sinus* is of the greatest surgical importance and consists of an outer or orbital portion, and an inner or nasal portion (Figs 1, 7, 8 and 11). The orbital portion is comparatively thin but dense. It has an attachment below for the pulley of the external oblique muscle, the dislodgment of which is undesirable. The more or less complete removal of the facial and this portion of the floor of the sinus is carried out in some operations directed toward the obliteration of the sinus, resulting in deformity according to the size of the sinus and the method adopted. The size and shape of some sinuses preclude obliteration.

The nasal portion contains the single ostium (Figs 15 and

17) leading to the nose, and is made up of both very thin and very thick areas of bone. It is bounded externally by the suture between the lachrymal and frontal bones and somewhat by the suture between the nasal process and the frontal bone (Figs 1, 7, 8 and 17). Internally it is bounded by the interfrontal septum, which is the upward projection of the plane of the nasal septum, although it may not necessarily be in the median line (Figs 5, 11, 13 and 17). In front the boundary lies roughly behind the upper border of the nasal bone and the nasal process of the superior maxilla (Figs 8 and 9). Although these bones do not form part of the wall of the sinus, they bear an important surgical relation to its floor. Posteriorly, the floor of the nasal portion comes to an angle made by three surfaces—floor of sinus, cerebral surface and interfrontal septum (Figs 4, 8 and 17). Toward this angle is situated the ostium. The floor in the vicinity of the ostium is made up of thin bone which forms the walls of some of the anterior ethmoid cells. External to the ostium are the cells, completed by the lachrymal bone. Posteriorly one meets oftentimes an ethmoid cell protruding into the sinus called the frontal bulla, and behind this are other anterior and then the posterior ethmoid cells (Figs 9, 10, 11, 15 and 18). In front of the ostium one is apt to meet an anterior cell and still further in front is the so-called nasal crest of frontal bone (Figs 7 and 8), and still in front are the thick and dense upper ends of the nasal bone and nasal process of the superior maxilla (Figs 12 and 13). Internal to the ostium and below it are thin lamellæ of bone subject to some immaterial variation, according to whether the ostium leads to the infundibulum or still further internal, so as to open under the forward projection of the middle turbinate bone (Figs 8 and 15). In all instances the frontal sinus can be said to open into the nasal cavity through the anterior upper portion of the ethmoid bone (Figs 9, 15 and 18).

Hence the ostium is surrounded on all sides by thin bone which may be fractured with comparative ease and thus a larger opening made. If this thin bone is broken away, and

this is usually what is accomplished by the majority of operators, what seems to be a reasonably large opening to the sinus is obtained. This may suffice for the cure of many cases, but many failures follow because the opening becomes obstructed later.

If the under surface of a disarticulated frontal bone be observed (Fig 7), the opening into the sinus will be found to correspond to the enlarged opening just described by breaking the walls of anterior ethmoid cells. It is commonly stated that this is the full extent of enlargement that the anatomy will allow, although some include the thin portion of the nasal crest of the frontal bone in this removal. Nevertheless, an opening in many instances nearly as large again may be obtained by removing a portion of the frontal bone which articulates with the nasal bone and nasal portion of the maxilla, together with the adjacent thick portion of these two bones (Figs 8 and 13). This will be considered further later on. Internal and posterior to the ostium is a dangerous region which, as a rule, should be carefully avoided because of the risk of breaking into the cranial cavity (Figs 9 and 17). The ostium is about on a level with the cribriform plate and the slit for the nasal nerve is internal and rather close to it, hence the great importance of the early introduction of a probe through the ostium which should be left there as a guide during the early part of the operation.

If a frontal bone be disarticulated, the following features will be observed in the region of the floor of the sinus around the bony opening, now comparatively large because the ethmoid cells are removed (Fig 7). Externally is seen the line of articulation with the lachrymal bone and posteriorly the ethmoid cells. Posteriorly and internally is found the front end of the cribriform plate (Fig 8), in front of which is a comparatively thin horizontal portion of the frontal bone called the nasal crest. This forms the inner boundary of the ostium. In front of the ostium, extending forward and toward the median line, is a dense and thick portion of bone of considerable area where the nasal process and the nasal bones

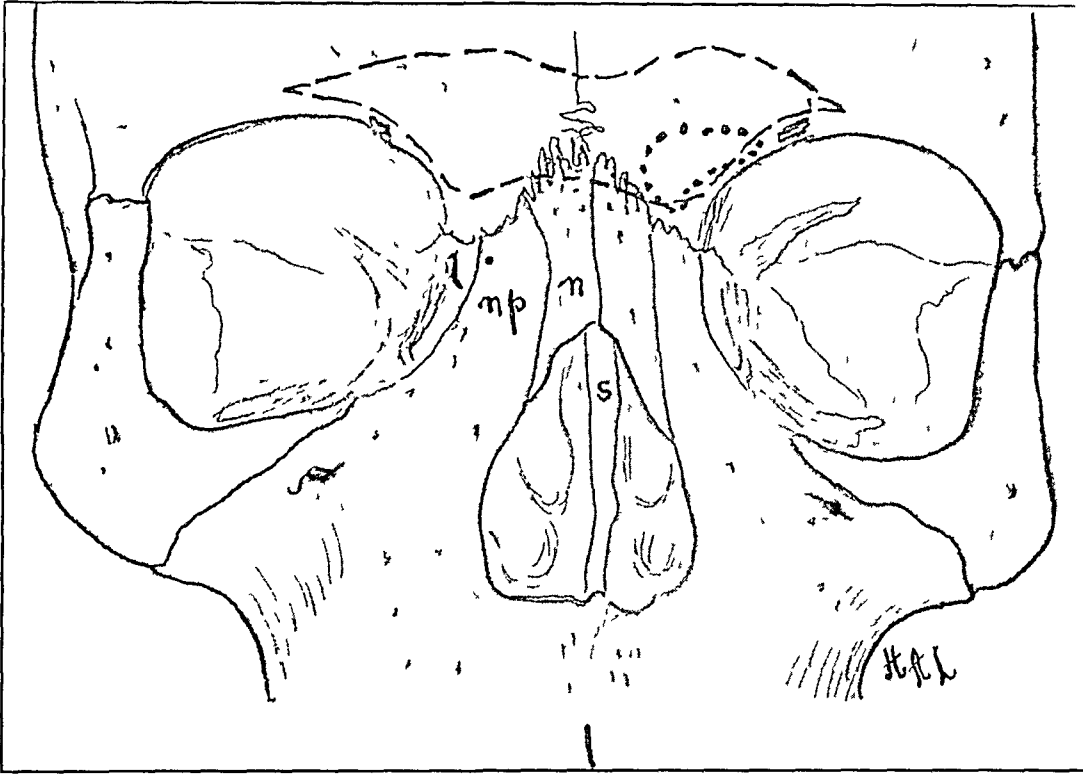
articulate (Figs 3, 4, 5, 8 and 13) This is a portion of the floor of the sinus which is not fully made use of in sinus operations

In the median line, still a part of the floor, particularly if we consider the two sinuses together, we observe the thickened portion of the frontal bone where the perpendicular plate of the ethmoid bone articulates and, in front of this, the spine of the frontal bone (Figs 5 and 14) In Figs 3 and 4 we note the extreme upward and forward prolongation of the middle turbinate bone, external to which are the infundibulum and ethmoid cells, subject to comparatively immaterial individual variations as to ostia and cells Internal to this lamella of the turbinate is the extreme anterior end of the roof of the nasal fossa formed in part behind by the cribriform plate (Fig 8)

If, on the other hand, we look down upon the section after the frontal bone has been removed (Figs 9 and 10), we observe again the structures around the bony opening from the sinus The lachrymal bone and groove for the lachrymal sac are to be seen externally and behind are the ethmoid cells and cribriform plate, internally is the perpendicular plate and in front are the thick upper extremities of the nasal bones and the nasal processes of the superior maxillæ Hence these two views (Figs 9 and 10) demonstrate why a probe is left in the ostium during the early stages of the operation to serve as a guide to enable us to avoid destruction of bone posterior and internal to the ostium These views indicate also the bone which may be removed in front and external to it

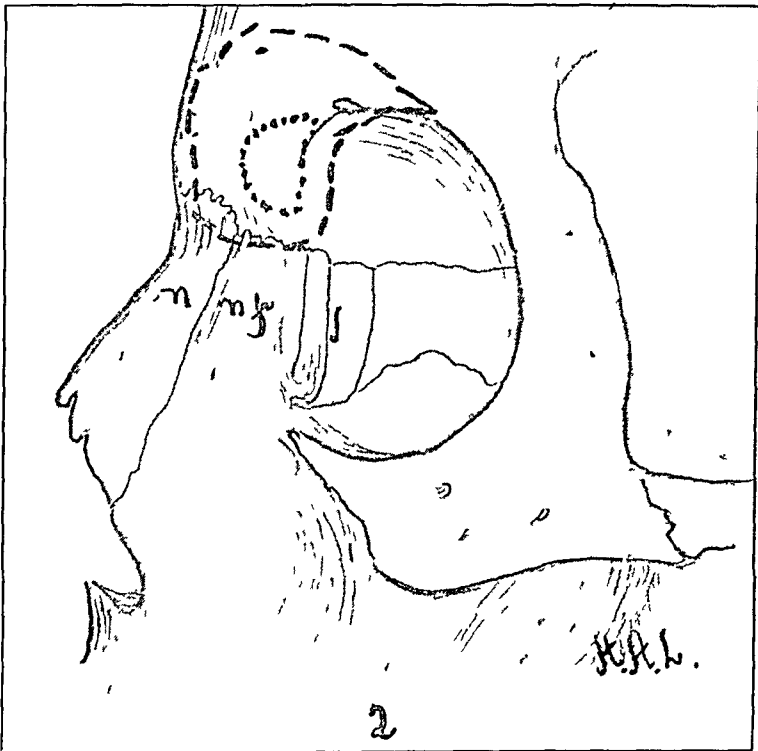
The distance between the front end of the cribriform plate and the upper ends of the nasal bones (Figs 7, 8, 10, 17 and 21) is also subject to variation, and the knowledge of this distance before operation is of great importance This can be determined by X-ray examination (Figs 21-26) A lateral view of this region will add to an understanding of its topography (Figs 4, 5, 10 and 21-26) Near the median line (Figs 4 and 5) the thinner portion of the sinus floor shows posteriorly, and in front it becomes very thick and dense, made up

FIG 1



Front view skull Projected outline of frontal sinus and opening into it *n* nasal bone, *np*, nasal process of superior maxilla, *s* septum of nose, *l*, lachrymal bone

FIG 2



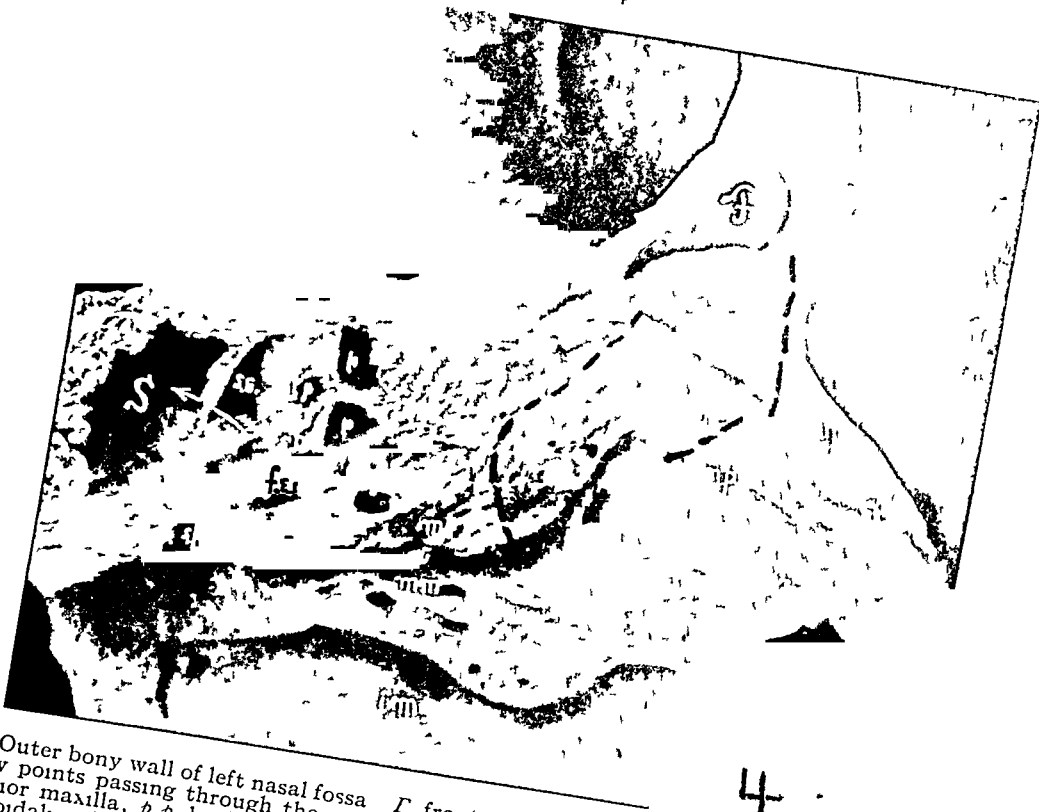
Side view showing projected outline of sinus and opening into it *n* nasal bone, *np*, nasal process, *l*, lachrymal bone with groove for sac and duct

FIG 3



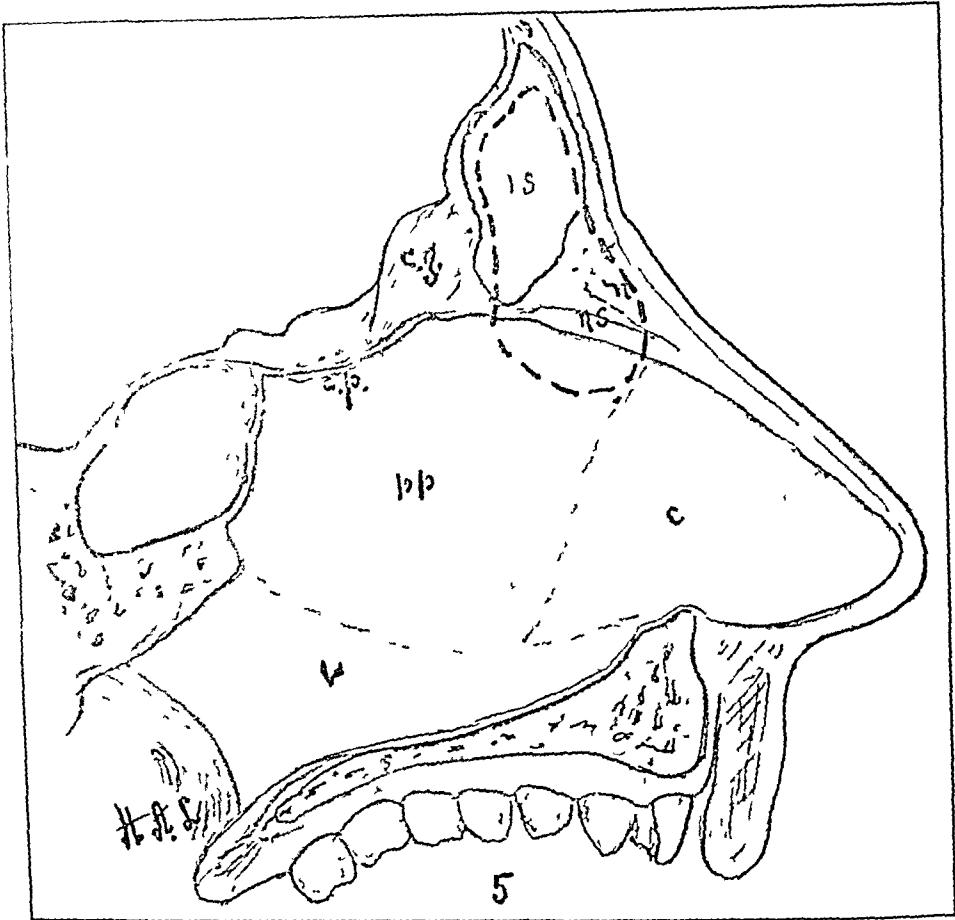
Outer bony wall of right nasal fossa. *f* frontal sinus, *S* sphenoidal sinus *sp*, sphenopalatine foramen, *fe*, inferior ethmoidal fissure arrow enters a posterior ethmoid cell from a middle ethmoid fissure, *a* an anterior ethmoid cell which makes a frontal bulla, *n* nasal bone *ns* nasal spine of frontal bone, *np* nasal process of superior maxilla *mt* middle turbinate bone *mm* middle meatus, *u* uncinat process, *it* inferior turbinate, *im* inferior meatus Dotted line shows the portion of bone to be removed

FIG 4



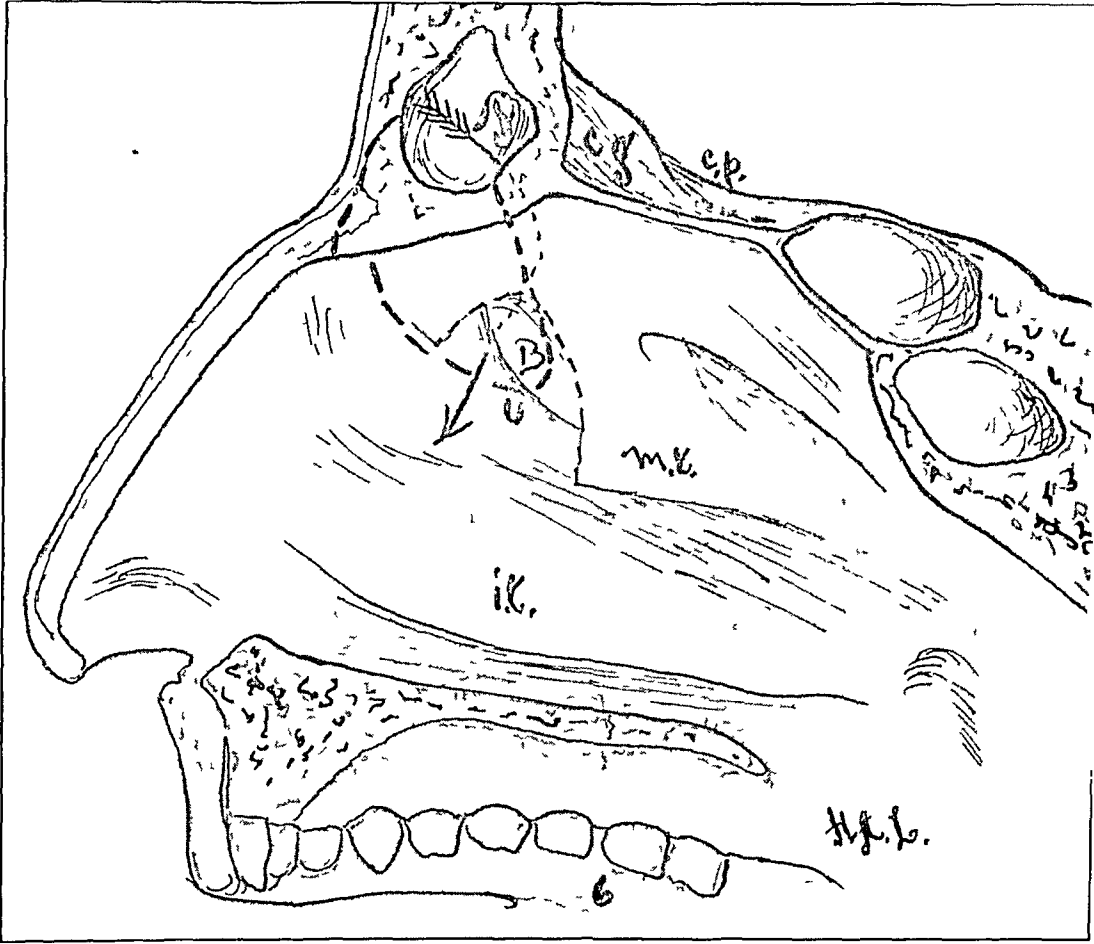
Outer bony wall of left nasal fossa *F* frontal sinus, *S* sphenoidal sinus into which an arrow points passing through the ostium sphenoidale, *n* nasal bone, *np* nasal process of superior maxilla, *pp* broken posterior ethmoid cells, *st* superior turbinate, *fei* fissura ethmoidalis inferior, *sp* sphenopalatine foramen *mt* middle turbinate *u* uncinat process, *mm* middle meatus, *im* inferior meatus, *it* inferior turbinate Dotted line shows the portion of bone to be removed

FIG. 5



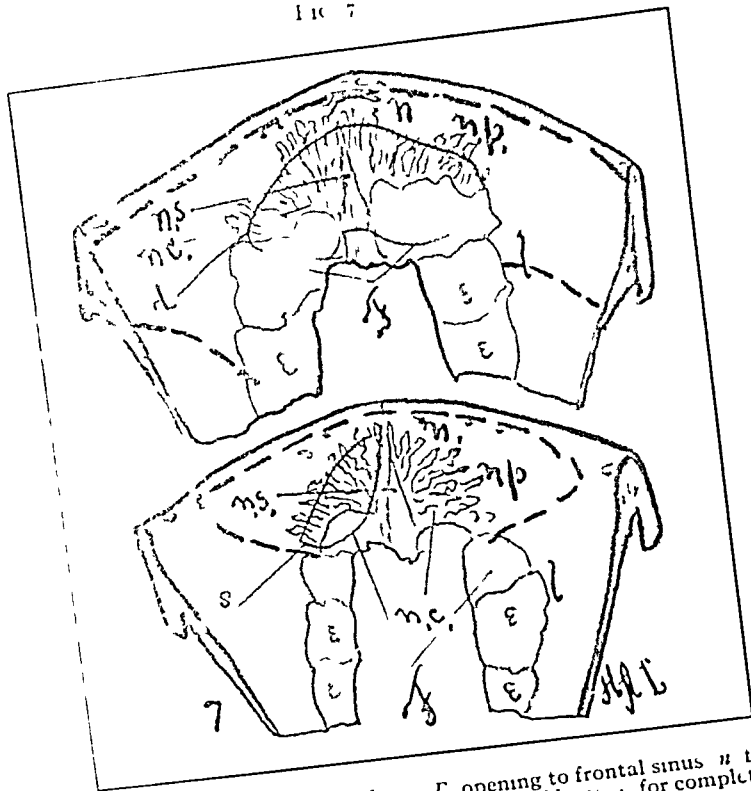
Shows interfrontal and nasal septum *n* nasal bone *ns* nasal spine of frontal bone, *cg* crista galli *cp* cribriform plate *pp* perpendicular plate, *v* vomer *c* triangular cartilage. Dotted line shows the portion to be removed in operations on both sinuses

FIG 6



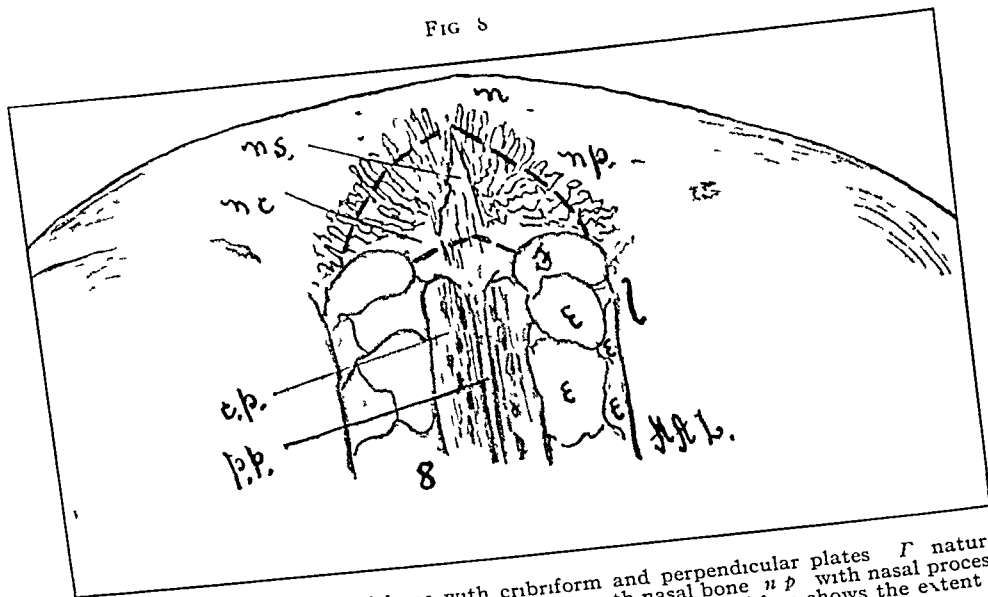
F, frontal sinus, arrow passes through its ostium coming out through the infundibulum at the hiatus semilunaris, *cg* crista galli, *cp* cribriform plate, *mt* middle turbinate, *it* inferior turbinate, *B* ethmoid bulla, *u* unciform process Dotted line shows the bone to be removed whether for single or double sinus

FIG 7



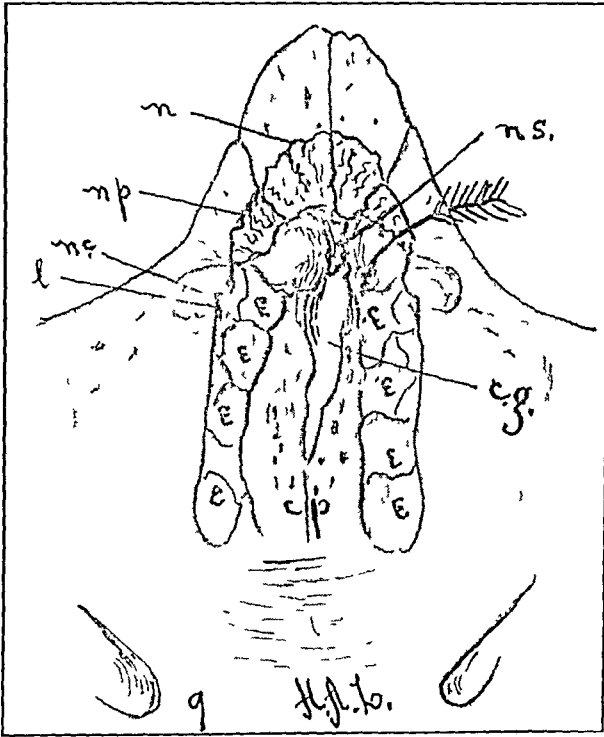
Part of frontal bone under surface Γ opening to frontal sinus n for articulation with nasal bone np with nasal process l with lacrimal bone e for completion of ethmoid cells ns nasal spine nc nasal crest s thick bone to be removed for a single sinus, d for a double sinus

FIG 8



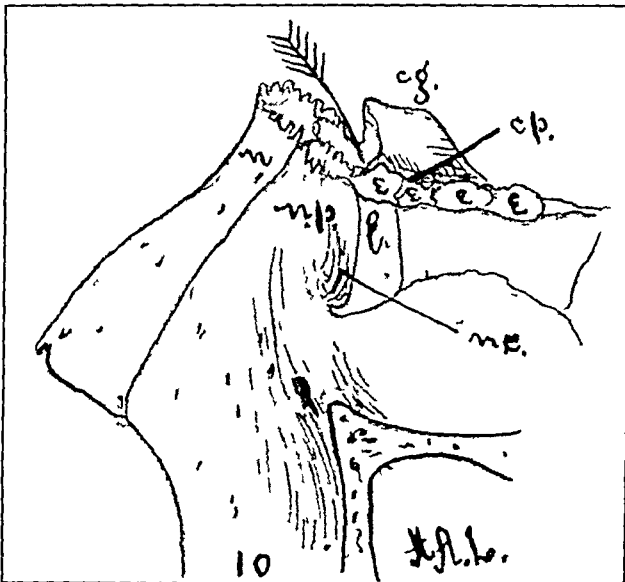
Under surface of frontal bone with cribriform and perpendicular plates Γ natural bone opening into frontal sinus n for articulation with nasal bone np with nasal process l with lacrimal bone e for completion of ethmoid cells ns nasal spine nc nasal crest s thick bone to be removed in operating on both sinuses

FIG 9



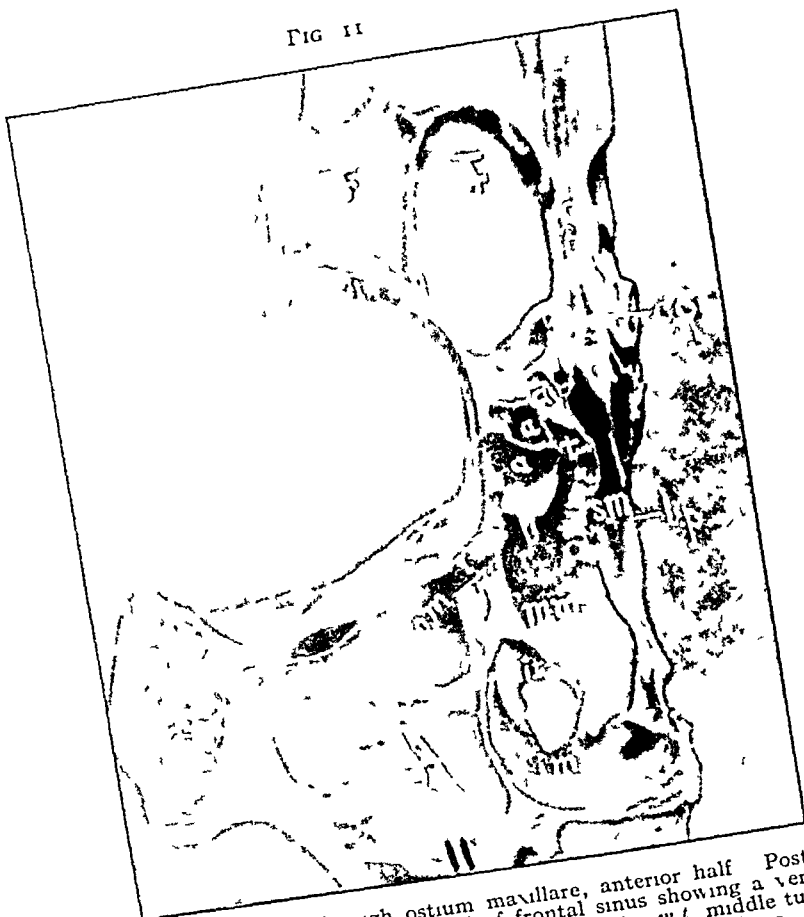
Showing structures under frontal bone *n* nasal bone, *np* nasal process, *l* lachryma bone, *nc* nasal canal, *cg* crista galli, *cp*, cribriform plate, *e* ethmoid cells Arrow through ostium of right frontal sinus

FIG 10



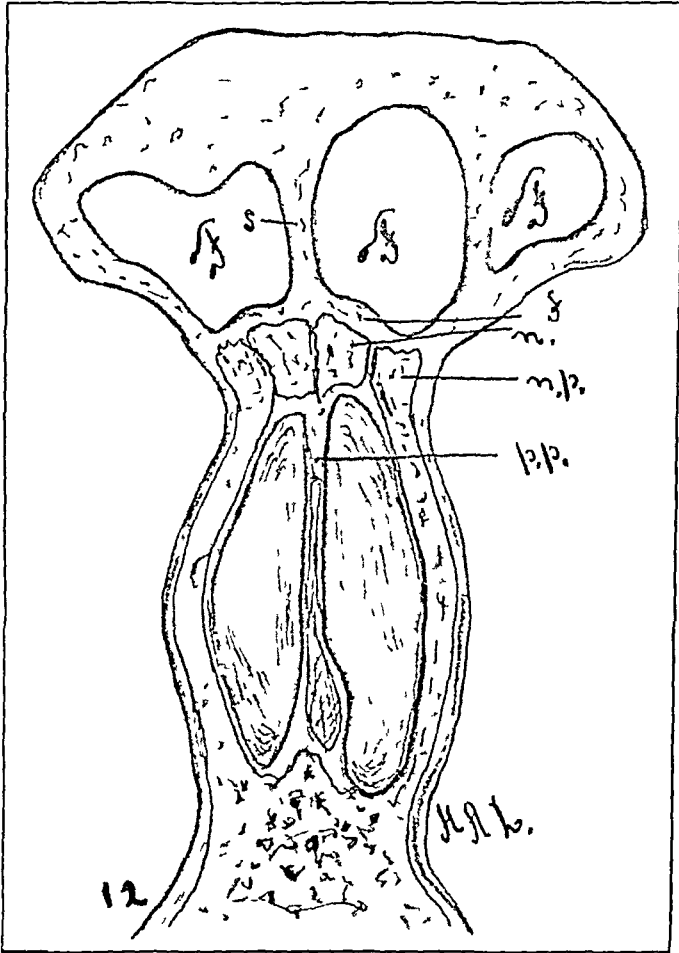
Side view of Fig 9 Same lettering

FIG 11



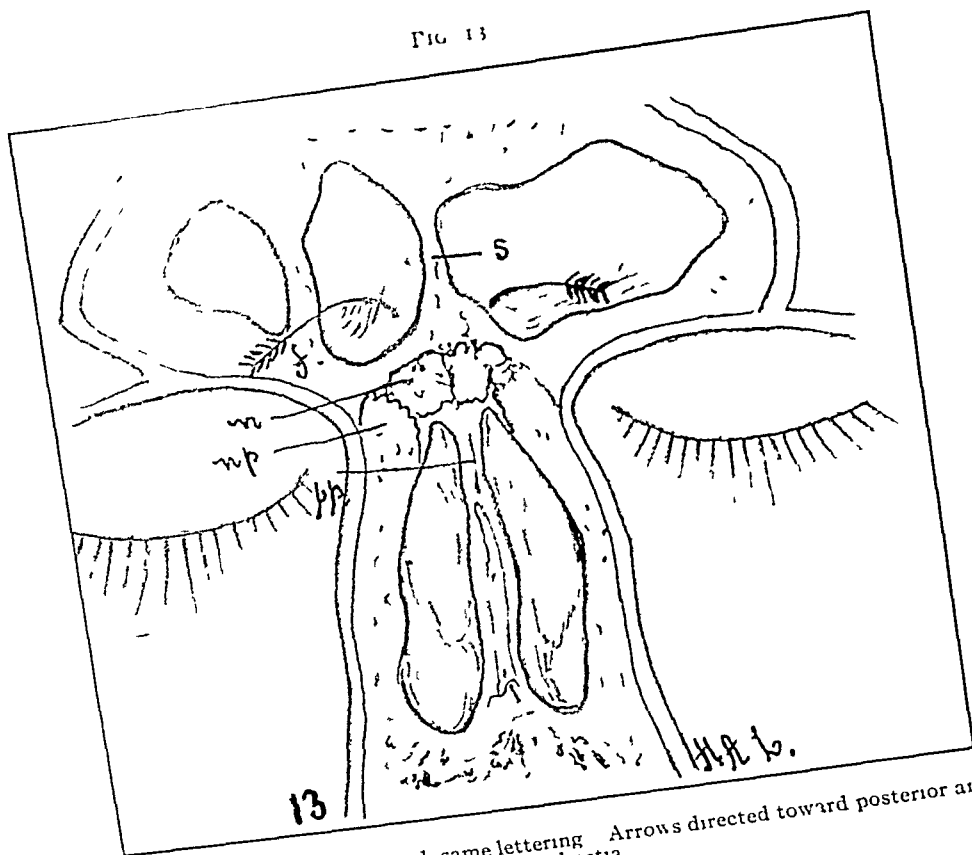
Bone Coronal section through ostium maxillare, anterior half Posterior wall of frontal sinus removed *F* an anterior wall of frontal sinus showing a vertical septum, *S* septum between the frontal sinuses, *t* inferior turbinate, *m* middle turbinate, *o* ostium maxillare, *u* uncinate process *l* os lachrymale *l* turbinate fossa, *a a a* anterior ethmoidal cells internal to lachrymal bone *A* antrum of Highmore, *l p* lamina perpendicularis, *c g* crista galli *i m* inferior meatus *m m* middle meatus, *s m* superior meatus, *i* inferior wall of frontal sinus (orbital portion) Dotted line corresponds to nasal portion

FIG 12

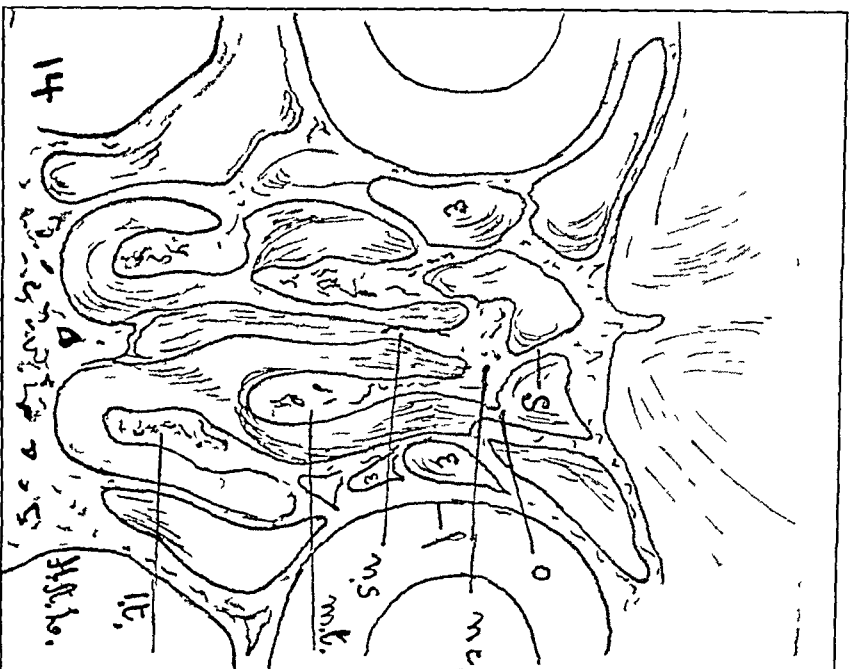


Sagittal section at base of nasal bones, looking forward *F*, frontal sinuses with a partition in the right side, *f* frontal bone, *n* nasal bone, *n.p.* nasal process, *p.p.* perpendicular plate of ethmoid, *s* interfrontal septum

FIG 13



Same as Fig 12 looking backward same lettering Arrows directed toward posterior angles to frontal ostia



Section of same specimen through region of ostia of frontal sinus—first looking forward and then backward same lettering *S* interfrontal septum, *ns* nasal septum, *nc* nasal crest, *mt*, middle turbinate, *it*, inferior turbinate, *of*, ostium frontale, *l*, lacrimal bone

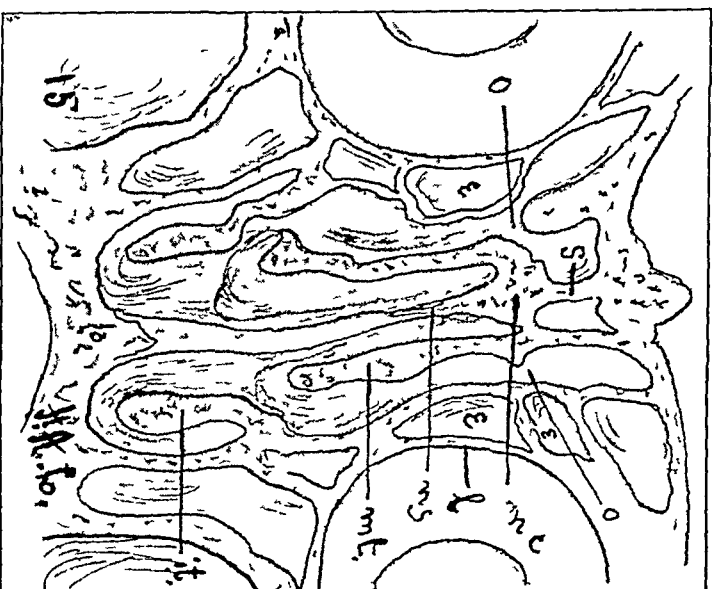


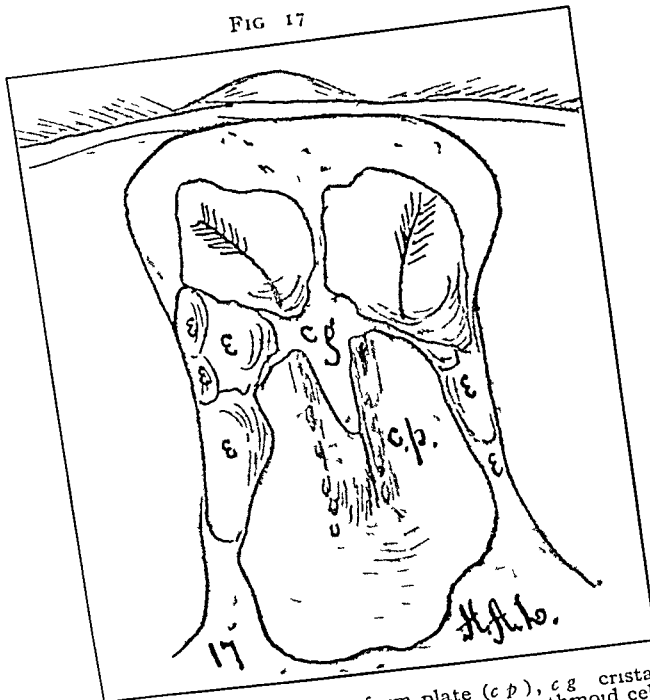
FIG 15

FIG 16



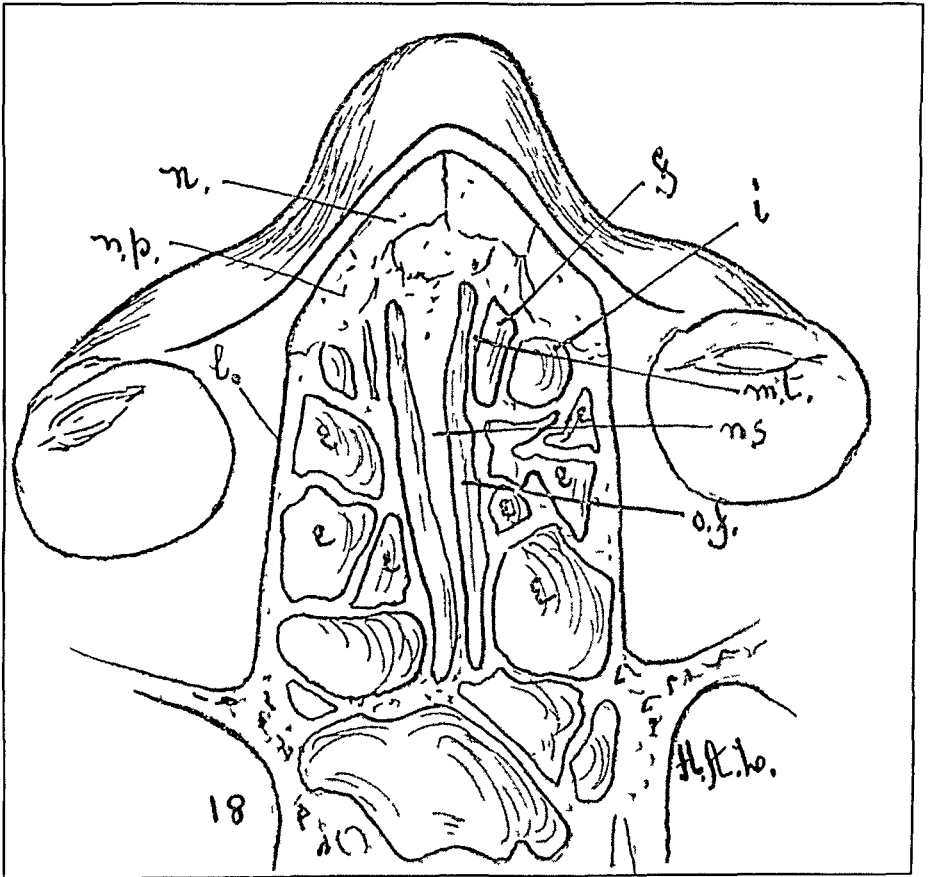
Sagittal section behind crista galli and ostia of frontal sinus looking forward
 cg crista galli cp cribriform plate ns nasal septum fb frontal bulla e ethmoid cells
 lt lacrimal bone mt middle turbinate lt lower turbinate u unciform process

FIG 17



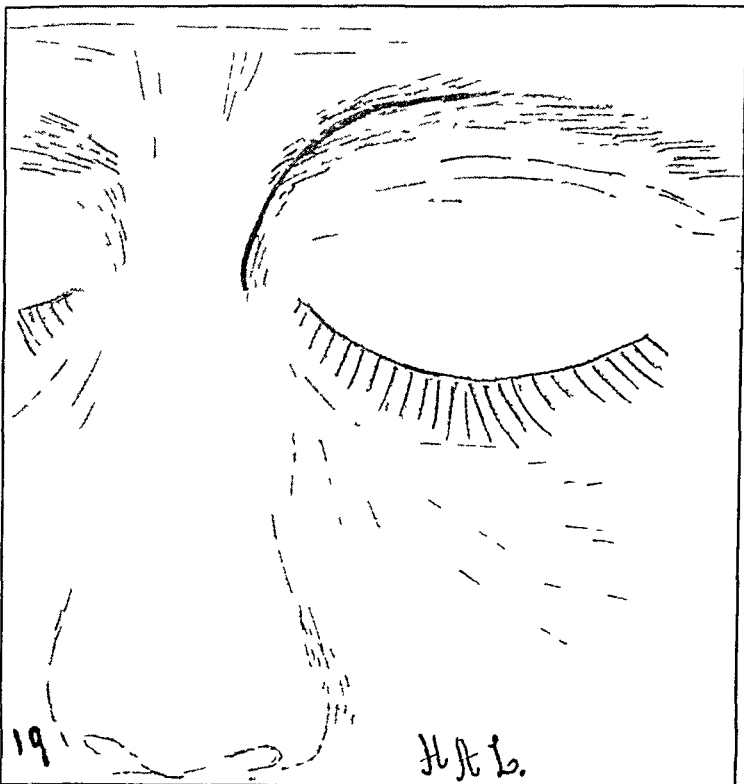
Horizontal section just above level of cribriform plate (cp), cg crista galli
 frontal sinuses directed toward ostium e ethmoid cells Arrows in

FIG 18



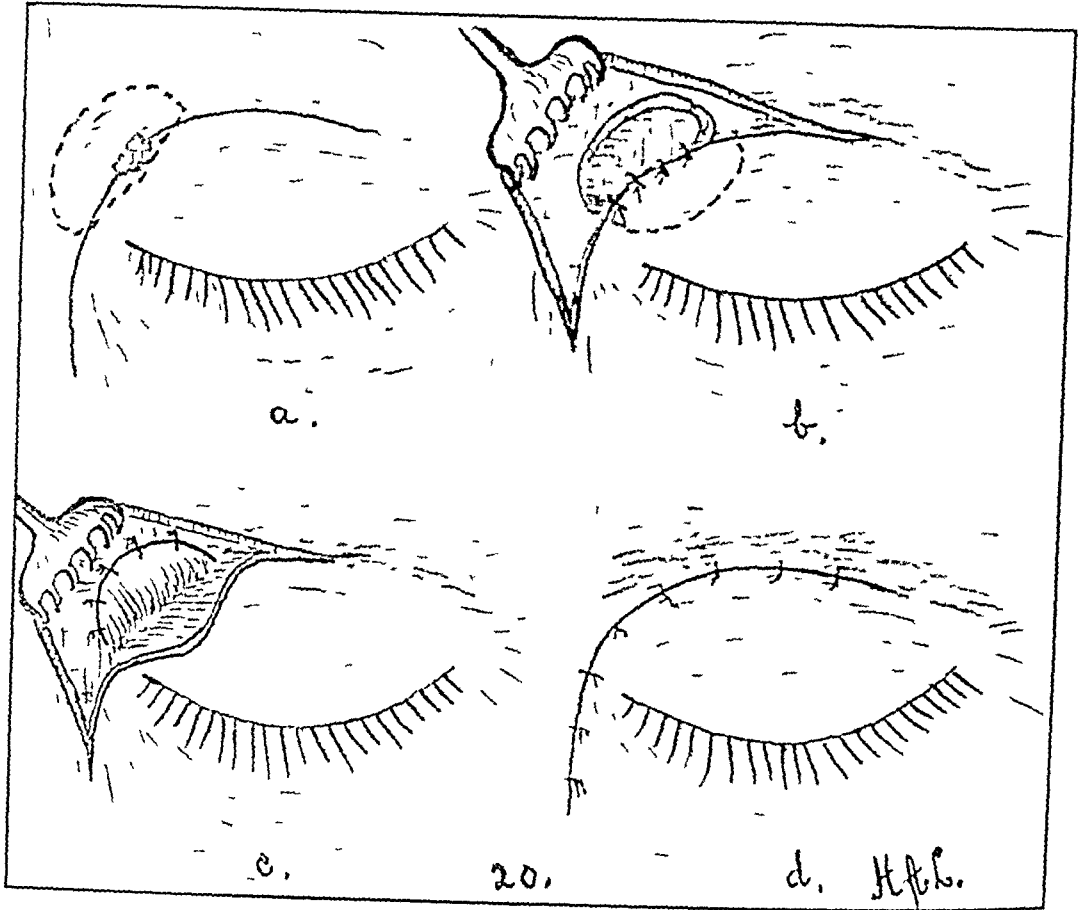
Horizontal section of same specimen just below level of cribriform plate *n* nasal bone, *n p*, nasal process, *l* lachrymal bone, *n s*, nasal septum, *m t* upward continuation of middle turbinate, *o f*, olfactory fissure, *f*, leading to frontal sinus, *i* infundibulum, *e*, ethmoid cells

FIG 19



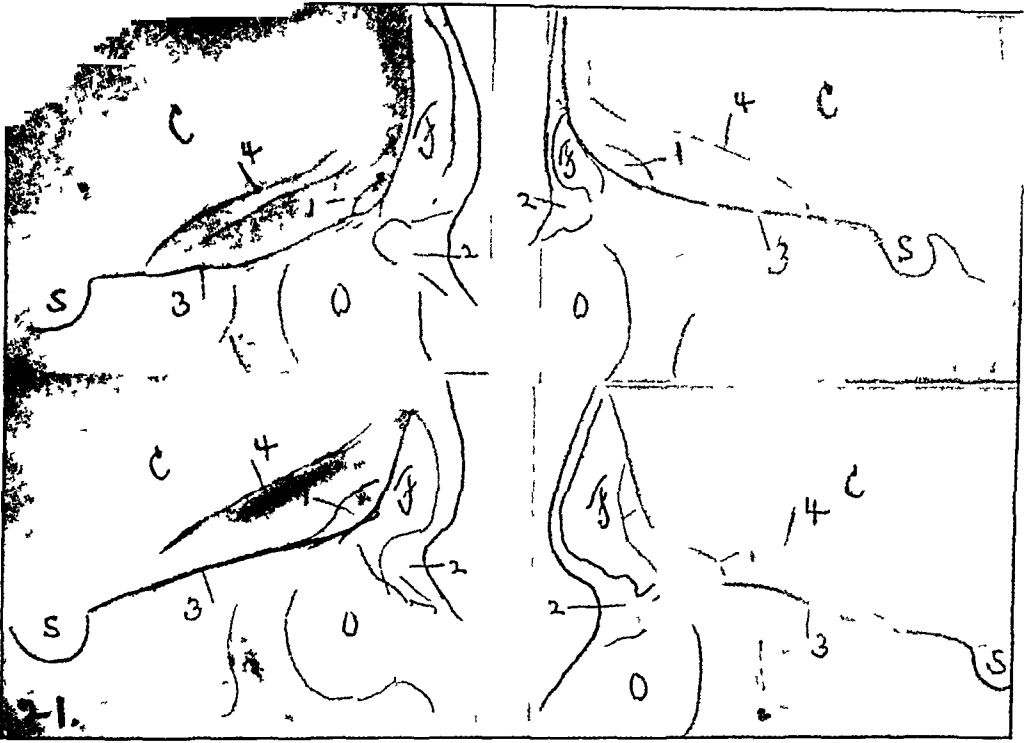
Showing skin incision

FIG. 20



Epidermization of frontal sinus a shows scar fistula and opening in bone, b bone exposed edge of lid sutured outline of skin flap, c flap sutured in place over opening to sinus d wound closed

FIG 21



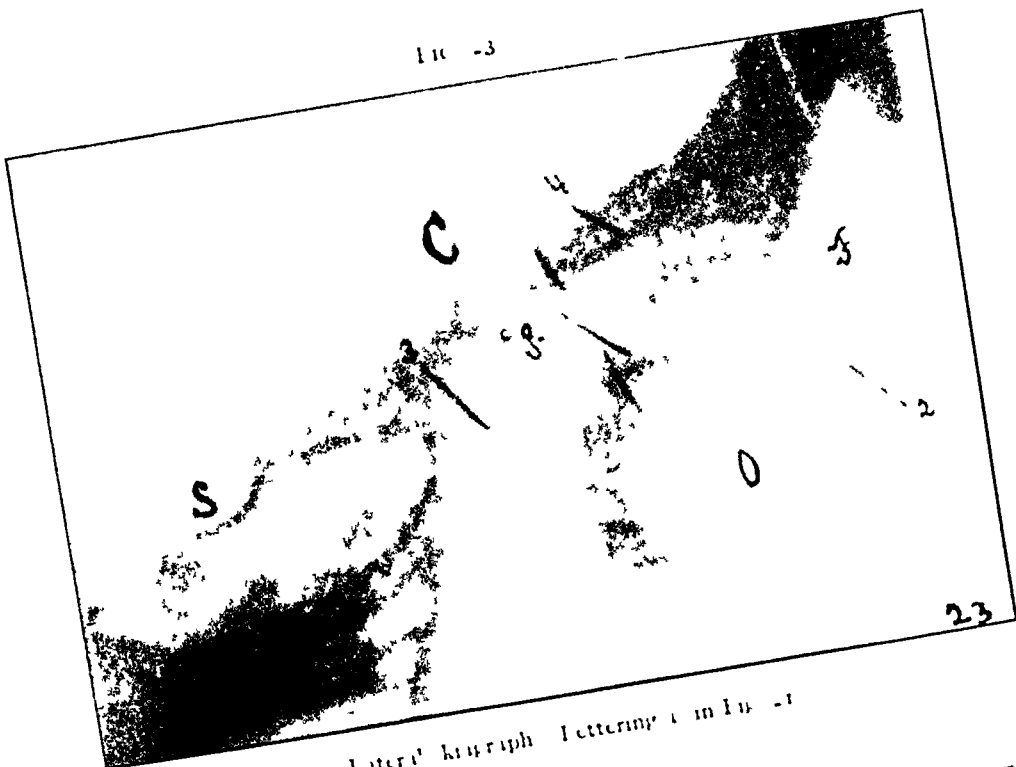
Tracings over lateral skiagraphs to show the dense bone at floor of frontal sinus in front and the relative distance between the base of the nose and the crista galli most of which can be utilized 1 crista galli, 2 dense bone made up of nasal and frontal bones and nasal process of superior maxilla, 3 cribriform plate continuing forward in the general curve of the cranial cavity, 4 roof of orbit, F frontal sinus, O orbit, C cranial cavity, S, sella turcica

FIG 22



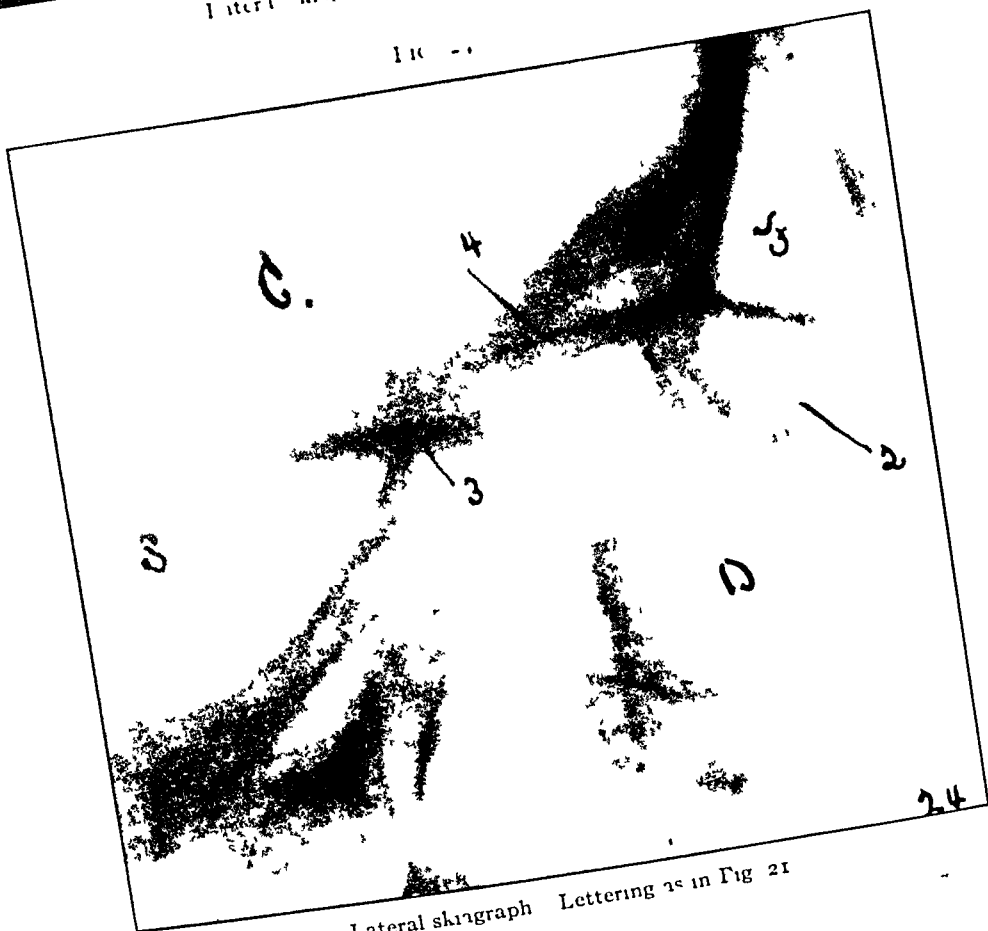
Lateral skiagraph Lettering as in Fig 21

Fig -3



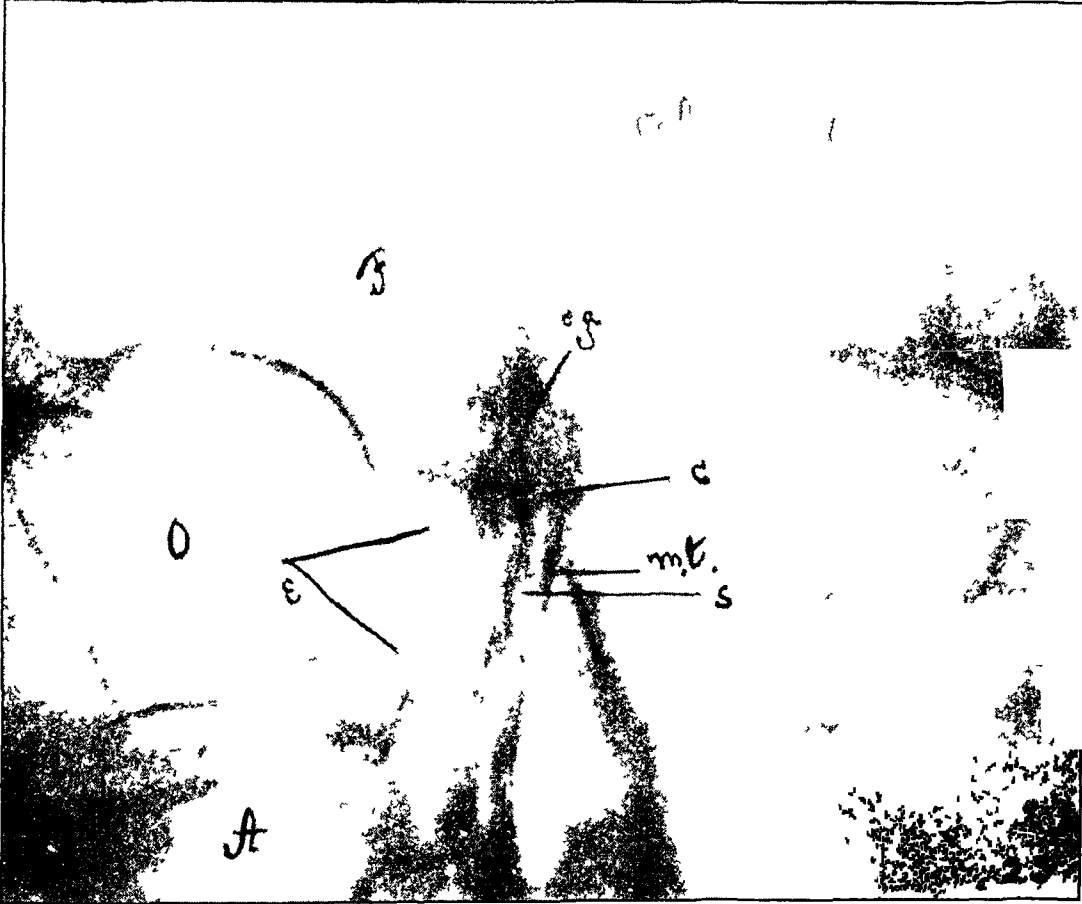
Interi' kringraph Lettering 'c' in Fig -1

Fig -4

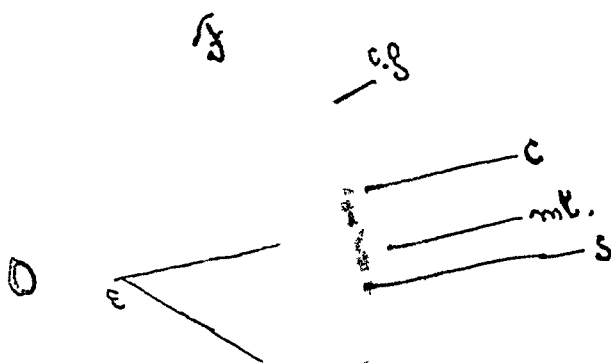


Lateral skingraph Lettering 'c' in Fig 21

FIG 25



Anteroposterior skiagraph *F*, frontal sinus, *O* orbit, *A* antrum *cg* crista galli, *c* cribriform plate, *S* septum of nose, *mt* upward projection of middle turbinate, *E*, ethmoid cells



A.

Anteroposterior skiagraph Γ frontal sinus O orbit I antrum $c.g.$ crista galli,
 c cribriform plate s septum of nose, mt upward projection of middle turbinate, E
 ethmoid cells

of the perpendicular ethmoid plate, nasal crest, nasal spine, and upper end of nasal bone. A little more lateral the floor has become much thinner posteriorly, but in front the nasal crest and upper end of nasal process of superior maxilla are still very thick. Sagittal sections (Figs 3-6 and 21-26) demonstrate this very thick bony ring in the anterior portion of the sinus floor.

The arrangement of ethmoid cells below the sinus will not be considered here in detail because they have been considered so frequently in other publications. Those having particular bearing are in immediate relation with the lachrymal bone, the inner aspect of the nasal process, and the so-called *agger nasi* cell, often present at the extreme end of the middle turbinate.

The *internal* wall of the frontal sinus is the interfrontal septum and its extent and position and the existence of frontal septa should be determined by X-ray examination. The septum is practically in the median line, but of course is subject to some variation. Its central portion is thin and its circumference thicker, particularly below, where it continues as the septum of the nose (Figs 5, 11 and 13). At its lower, posterior angle is the crista galli, which is separated by the posterior wall of the sinus. Occasionally the sinus itself projects into the crista galli, a fact which should be borne in mind. However, this angle is behind the guiding probe and should never be interfered with. The front corner of the cribriform plate may project well into this angle at the base of the crista galli (Figs 9 and 17).

Hence, to summarize the practical points brought out by the above

The region of the ostium of the sinus is surrounded by thin bone.

The whole nasal floor of the sinus represents the maximum area for the acquiring of drainage.

The area posterior and internal to the ostium is comparatively small, and it is too dangerous a region for interference, although, with great care, a protruding ethmoid cell may be destroyed.

The area in front and external to the ostium is by far the larger and is comparatively thick and dense. All of this may be removed with comparative safety by means of special instruments.

The partition between the sinuses and its continuation into the nasal septum (perpendicular ethmoid plate) may also be removed without risk and thus extra space be gained.

X-ray examination in two planes must be made before operation, in order to determine certain relations which are variable.

A clear understanding of the lymphatic and venous channels of drainage is necessary in order to determine subsequently the extent and location of infection. There is some drainage into the superior longitudinal sinus and also into the lymph-vessels of the cranial cavity.

Röntgenologic Examination—The Röntgen portrayal of the conditions in and about the sinus is of great importance, partly as an aid to diagnosis, but particularly as a means of determining the site and dimensions of the sinus.

Slight pathologic changes in the region could not be detected, but extensive alterations in the density would be evident. Hence, as an aid to diagnosis, the skiagraph may be of some value, but other signs are of greater importance. I believe the chief value of X-ray examination is the portrayal of the anatomy of the region, for thus we are enabled to picture anatomic features of paramount importance. The site of the sinus can be established so that the exploratory opening can be made with the assurance of entering it. The lateral views will determine the amount of space between the front end of the cribriform plate and the base of the nose, a factor of great importance in the technic to be described.

Two views should be made—an anteroposterior and a lateral one. More than ordinary precision is required, both as to symmetry and point of focus. Dr. Percy Brown has devised an apparatus for fixing the head and obtaining most satisfactory skiagraphs in these difficult cases, and to him I am also indebted for the illustrative prints ("The Diagnostic Evi-

dence Obtained from X-rays from the Lateral Aspect of the Skull " *Boston Medical and Surgical Journal*, June 12, 1913) Anteroposterior views give us the height of the sinus, the level of the cribriform plate, and the width of the space between the lachrymal bones. The lateral views show all the anteroposterior dimensions, particularly the available space for enlarging the opening, and the position of the crista galli and the front end of the cribriform plate. The base line of the cranial cavity can always be demonstrated.

Transillumination is not of much diagnostic or operative value, and reveals nothing that cannot be discovered by other means. A sinus filled with pus or hypertrophied tissue or a small sinus might be suspected as a result of such examination. No operative guides can be made out. Hence contributory evidence may be obtained.

Technic of Operation—Preliminary to any external operation upon the sinus, effort to cure by intranasal methods along safe lines should have been thoroughly tried. This means that the front of the middle turbinate has been removed and many anterior ethmoid cells broken through. X-ray findings should have been carefully studied. Application of a four per cent solution of cocaine and adrenalin (1-2000) to the extreme upper front portion of the nasal cavity will lessen materially the amount of hemorrhage. The usual bone cutting instruments and slender curettes should be selected, but the essential portion of the operation is performed solely by means of burr drills of selected sizes mounted on curved and straight shanks. The burr drills devised by Tilley and Ballinger for antrum operations serve our purpose well, particularly those with the curved shank.

The patient is placed in a sitting posture and the head kept horizontal most of the time. There is less shock when the patient is placed semirecumbent, and this position may be selected, but greater caution is needed to keep in mind the anatomic relations and hemorrhage may be more troublesome.

In order to avoid the annoyance of blood escaping into the pharynx, the posterior nares may be plugged or, better still,

narrow strips of gauze may be introduced *via* the anterior nares, leaving the front half of the nasal fossa free for operation. Ether should be administered through a tube entering the mouth to the pharynx, so as to avoid any delays or annoyance from this source

The incision is the middle portion of the one used in the Killian operation and, in fact, the one adopted for most of the frontal sinus operations. It extends from about the centre of the unshaven eyebrow inward and then downward a short distance on the outer side of the nose. The supra-orbital nerve may be spared in some cases (Fig. 19). An area of bone at the base of the nasal process and nasal bone and above is exposed and denuded of periosteum. The sinus should be entered just above the base of the nasal process (Fig. 2), easily accomplished by means of small chisels and gouges, and enlarged by rongeur forceps. The sinus is then explored by means of a small probe. The ostium will be found situated toward the posterior angle. Pass the probe down into the nose and out the anterior nares. The upper end should protrude through the wound and be bent so that the probe will stay in place of itself. Pass small curettes from above down through the floor of the sinus, always in front of and external to the probe at the ostium. Thus, the thin walls of anterior cells are broken up until the ostium becomes considerably enlarged. During these manipulations or earlier the walls of the sinus should be freed from excessive granulation tissue or polyps, if such be present. If the mucous membrane of the sinus is not materially hypertrophied, it is probably better not to curette it, for thus we obtain a better chance for resolution after the lower obstruction is removed. However, if there is much hypertrophy, ulceration, etc., the thickened portion should be curetted, but the periosteum of the lining of the sinus should not be removed. If distal portions of the sinus are already practically obliterated by dense scar tissue, do not disturb it.

The object of this minimum of curetting is to impair as little as possible the nutrition of the bony walls of the sinus

and thus avoid subsequent necrosis. After a short time the sinus hemorrhage will be practically arrested and the vicinity of the ostium can be inspected. Almost all of the subsequent work is performed by the burr drills, introduced chiefly through the nose so that the burr is almost always in sight. These instruments are to be used just as a dentist reams out the carious portion of a tooth. No other instrument can be used for this purpose, because the part to be removed is otherwise inaccessible, and the use of chisels and rongeurs would be dangerous and inexact. The burr gnaws away the bone with precision and safety. At first the smaller burrs are introduced through the anterior nares to the region of the guiding probe. First, the nasal crest is removed and the process continued anteriorly toward the nasal bone and nasal process at about their upper suture line. As the opening becomes larger the larger burrs can be used. By this means this portion of the nasal bone and the nasal process of the maxilla, together with the adjacent part of the frontal bone becomes very thin and there remains only a bony shell around the circumference of the enlarged ostium. It is surprising how large an opening can thus be obtained. By means of the burr drill and a curette the ethmoid cells, which may be present at the upper end of the infundibulum and opposite the lachrymal bone, and the agger nasi cell should be destroyed. While working opposite the lachrymal bone, the finger should be pressed gently in the inner canthus to serve as a guide and for protection. The lachrymal bone and the external surfaces of the ends of the nasal bone and nasal process should not be broken through, for these thin shells will serve to keep the region of the ostium from sinking in. This I believe to be the usual cause for failure in the modern radical operation where this portion of the wall has been destroyed.

Recent cases operated upon have demonstrated the wisdom of making use of the combined nasal floor of both sinuses, even though only one sinus is pathologic, in the manner described below for operation in cases in which both sinuses are involved. The mucous membrane of the healthy sinus does not become

diseased and the proximity of healthy mucous membrane favors early epidermization. Furthermore, the single opening in the facial wall gives ample opportunity for the complete operation, because we do not care to reach the distal portions of the normal sinus. A large part of the interfrontal septum is removed and, if desired, we could readily probe and curette the healthy sinus.

If both sinuses are involved, the opportunity for a large opening is most excellent. The X-ray findings have already shown the topography of the sinus and, in particular, the distance between the crista galli region and the anterior contour of the sinus and also the extent of the interfrontal septum. The opposite sinus may be opened and its ostium enlarged in the manner described above. Then this septum is perforated in its thin, central portion and its anterior and lower portion enlarged with the burr, gradually approaching the floor of the sinus. We are now at the base of the bridge of the nose, behind which is much dense bone in the vicinity of the median line where the septum of the sinuses and that of the nose meet. This can be removed readily with the burr in view, leaving a thin protecting shell of bone in front. The portion of the septum of nose just below the sinuses should be removed also with the burr. This is made up of the perpendicular plate of the ethmoid and is to be removed for a depth of nearly one inch (Figs 5 and 13). As in any sinus operation, the posterior angle of the sinus and the region of the front end of the cribriform plate should be avoided at all times. It is surprising to observe in the average sinus how much space for drainage can thus be obtained. From below a comparatively large instrument can be swept across from one sinus to the other and from either nostril into either sinus. The removal of this median partition adds so much more to the efficiency of the drainage that I believe it should be done even in cases where only one sinus is involved. It may, at first thought, seem an unwise step but I believe it will work for good and not harm in every instance. A sinus is opened frequently for exploration and generally without ill effect but, if any harm does

follow, it is because of accumulated blood clot which cannot escape and which becomes infected. In these cases where the opposite side is opened, there is no chance for retention and the healthy mucous membrane does not become infected and pus is not retained. This is on the same principle that an antrum may act simply as a reservoir in frontal sinus suppuration and give no further trouble after the latter is cured. Furthermore, the chance for drainage is poor compared with that of the frontal sinus treated as above. Besides obtaining a very large opening, another advantage of connecting the sinuses is the fact that the mucous membrane of the healthy side allows epidermization in the vicinity of the new ostium on the diseased side. In skilled hands the whole operation can be accomplished through a single external opening, although a double opening is safer.

By the time the operation is completed the hemorrhage has practically ceased. With the head tipped forward, the external wound should be washed with a sterile solution and the skin incision closed. The tampons are to be removed from the nose and a compress bandage applied. The after-treatment is the same as in any case. Irrigation should be avoided for several days. As the intranasal areas begin to granulate around the ostium they should be kept clean and smooth by the usual methods. The whole sinus cavity is now particularly accessible for treatment.

The Closure of Fistulæ —Fistulæ are the result of obstruction at the ostium and may arise spontaneously or after operation. If the ostium becomes occluded during the course of an acute inflammation and remains so, an empyema or practically an abscess results, which in turn will cause a perforation of one of the walls of the sinus. An external fistula results if the perforation takes place through the facial or orbital wall; this tends to last indefinitely until corrected by operation. Following operation, where an attempt has been made to enlarge the ostium, a fistula may develop in the line of incision. This may appear after a few days, weeks or months, and is due to the fact that the opening has become obstructed, partly by

œdema and later by granulation tissue at the site of the ostium. These external fistulæ will remain closed only after a permanently patent ostium has been established by some means or other. It is fair to assume that this complication occurs in the obstinate cases which require more careful and radical treatment. Here again the operator must decide whether he will attempt to obliterate the sinus or establish a large ostium.

Epidermization of the Sinus—During the operation upon one of the obstinate cases, where an external fistula had existed in each sinus for over a year, Dr. O. A. Lothrop suggested the possibility of epidermizing the frontal sinus as is sometimes done after mastoid operations. I do not know that this has ever been attempted in the frontal sinus, but I felt that if the vicinity of the ostium could be protected with epithelium it would lessen the chance of granulation obstruction and the flap would serve as an island whence epithelium would tend to spread in all directions over the remaining sinus wall, as after the manner of any skin graft. This case was particularly obstinate because the supporting wall of the upper part of the lachrymal bone and nasal process had been removed by previous operators.

The following technic was devised and carried out and the parts have remained closed, an interval of twenty months having since elapsed. Just how much spread of epithelium has taken place it is impossible to determine. The sinuses were large and at the present time there is no discharge and the patient considers himself cured.

The steps are as follows, as illustrated in Fig. 20. After the vicinity of the ostium has been enlarged to as great an extent as the anatomy will allow, as described above, the edge of the skin of the upper lid is sutured to the periosteum on the outer edge of the bony opening into the sinus with small catgut (Fig. 20, *b*), then an oval incision is made in the lid down to the muscle fibres, so as to form a flap about the size of the opening in the bone. The blood supply of the lid is excellent and the flap is very movable so that it turns readily without much cutting after division of the thin skin of the lid. The

flap is now to be turned so as to cover the bony opening and is sutured to periosteum, preferably with fine chromicized cat-gut. Then the parts are washed carefully with a sterile solution and the remaining wound is closed. The lid is to be drawn across horizontally and it will be observed that there is very little tension and subsequent oedema, and that the motion of the lid is not interfered with. In the two instances where the sinus was grafted, the scar is scarcely perceptible in one and in the other the depression is moderate and is due to the previous extensive destruction of bone.

This paper is designed to present general principles and a technic for operation. A list of cases operated upon is not included, as thereby nothing would be added to what has already been said.

BLEPHAROPLASTY BY A PRE-GRAFTED FLAP.*

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IN the late nineties while acting as surgeon to the Work House and Almshouse Hospitals I had several opportunities to see the end results of plastic operations performed for the relief of tissue defects resulting from excisions of epitheliomata of the eyelid. These were, in general terms, very bad, very unsightly, and very uncomfortable. The plastic flap in most of these cases was tightly stretched across the eye-ball and adherent to the conjunctiva, causing discomfort and distress and lamentable cosmetic appearances. It occurred to me then that in attempting to reconstruct the eyelid we ought to keep its functions in mind and try to reproduce them in any reconstruction work.

A proper eyelid is, of course, smooth, is lined with an epithelial layer, in this case representing the mucous membrane of the conjunctiva, and of course is free from the eye-ball. It seemed to me, therefore, that any transplanted flap which was to replace a gap in the eyelid should have an epithelial lining. This epithelial lining could, of course, be supplied by applying a skin graft to the back or raw surfaces of a pedunculated flap and there is sufficient evidence that epidermis transplanted into mucous lined cavities assumes to a sufficient degree the characteristics of the mucous membrane.

I found that quite naturally the same idea had occurred to others, that is, after plastic flaps had been made, to fill the gap in the eyelid, a skin graft was put on the reverse side. Personally, I never had any opportunity to verify the results, good or bad, of this procedure, but I knew from general experience that skin grafting under these conditions gave no

* Read before the American Surgical Society, April 11, 1914

assurance of successful union I determined, therefore, to devise a method which would allow the transplantation of a flap which already satisfied these conditions

My first case, Lena W, presented herself ten years ago and gave me the opportunity to carry out these theoretical requirements In her case I deliberately chose to utilize the form of plastic advised by Dieffenbach, which I believed would assure me the best kind of flap with which to carry out the preliminary grafting, although the flap itself, having a pedicle lying vertically below the eyelid, possessed the disagreeable feature of drawing down the eyelid and the result was not any too satisfactory on account of the inherent defects of the flap, although the requirements, namely, a movable eyelid with the internal surface lined by epithelium and nonadherent to the conjunctiva, were obtained In my second case I chose to make the flap recommended by Fricke but more nearly horizontal, and the result was so satisfactory that it is this operation that I describe and recommend

We start out then with the idea that we shall outline the flap and prepare it by grafting its inner surface and only remove the lesion (epithelioma) and transplant the flap into the resulting cavity when the flap shall have been demonstrated to be properly prepared to take the place of the eyelid A two-stage operation then becomes a necessity The various steps of the operation are readily understood by a study of the accompanying illustrations The preliminary operation might be done, if necessary, under local anæsthesia but I should prefer it to be under a general anæsthetic, as was done in both cases, so that the outlines of the flap should not be obscured by infiltration of cocaine or possibly the wound healing so jeopardized The first step consists in making an incision through the whole thickness of the skin, starting at the external canthus and running somewhat obliquely upward for a suitable distance, according to the size of the flap required In my two cases the lesion occupied the external half of the lower lid and a flap one and three-quarters inches was outlined Fig. 1 shows the single incision through the skin, the dotted lines show the area of the proposed flap By dissecting down through

the preliminary incision a pouch is made corresponding to the size of the eventual flap and into this the skin graft can be tucked, just as one places a handkerchief in the pocket. A single skin graft of suitable proportions is cut and is introduced into the pouch, as shown in Fig. 2. It is a little larger in its vertical diameter than is necessary, allowing the top portion to be turned over on the raw edge of the flap. That completes the first stage of the operation. A protective dressing is applied and the graft is allowed to heal in place and the transplantation is not made until the healing is an accomplished fact and no raw surface exists. That would ordinarily take about 10 days.

At the second operation the epithelioma is excised by removing the outer half of the eyelid by a quadrangular incision, the outer vertical leg of which just impinges on the skin out of which the pre-grafted flap is composed (Fig. 3). In Fig. 4 is shown a horizontal incision parallel to the first original incision, thus freeing the flap and allowing it to be slid over into the gap left by the excision of the epithelioma. Fig. 5 shows the flap sutured into place and the operation completed. The healing takes place readily in less than a week. The after-results have been satisfactory, as can be seen by the photographs of these patients. While the result in patient one is not quite satisfactory it is because the poor type of flap was used, but even then the advantages of the pre-grafted flap are obvious in that there is a free palpebral margin lined with a perfectly satisfactory substitute for mucous membrane which it now closely resembles. The preliminary operation allows for the occurrence of a normal shrinking of the flap and in making these flaps it is only necessary to cut them of the exact size necessary to fill the gap. This fact I learned by experience in these two cases where in each instance following the general principles of plastic surgery, the flaps were made over-generous with the expectation that they would subsequently shrink. This shrinkage did not occur and in both cases we have an over-generous palpebral opening. Ten years in Case 1 and seven years in Case 2 have elapsed since these operations, and



FIG 2

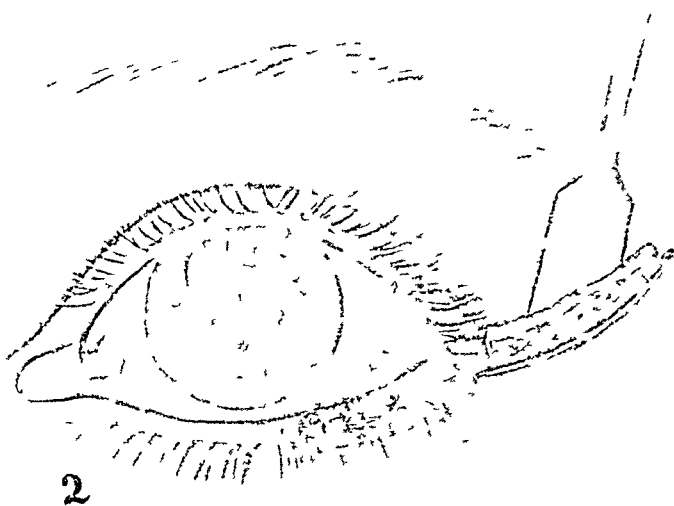


FIG 3

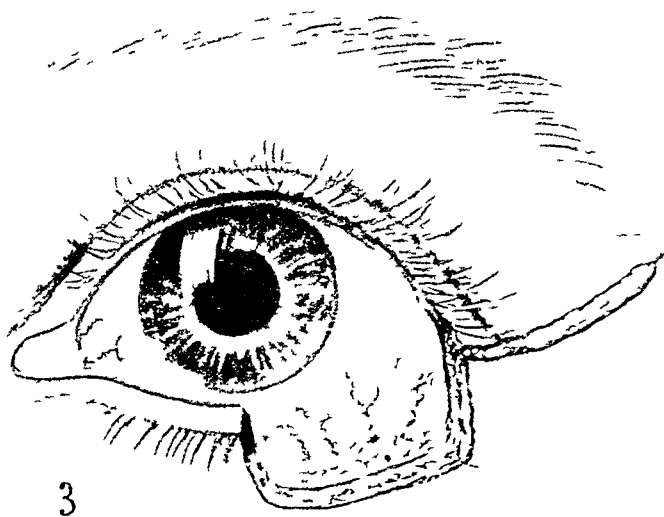
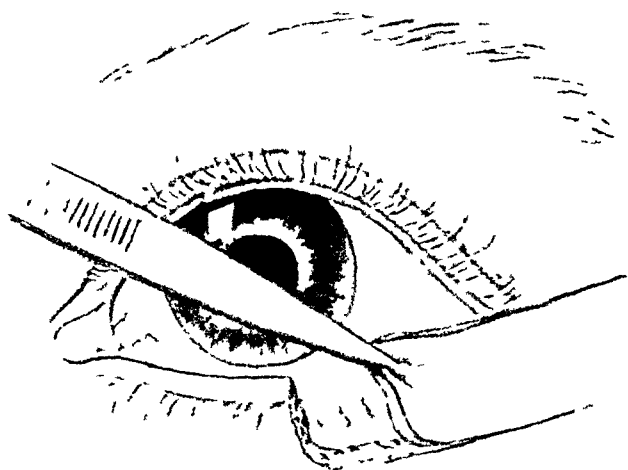
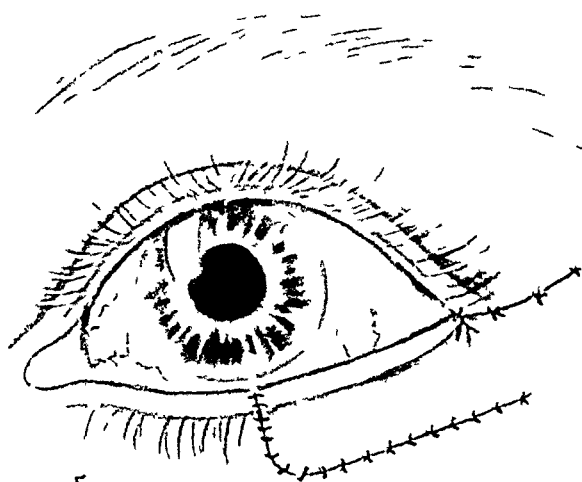


FIG 4



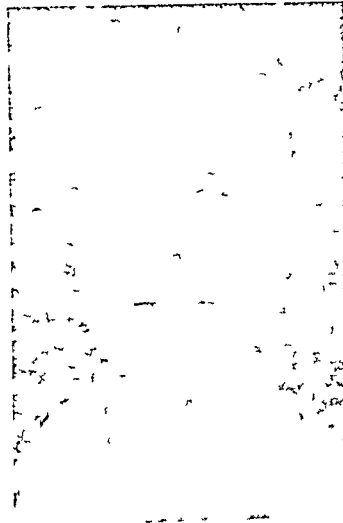
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FIG 5



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FIG 6



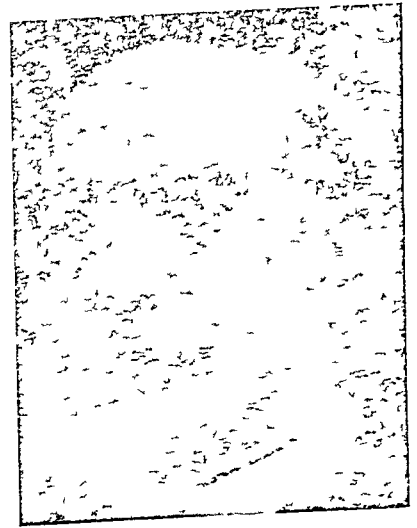
Case I Ten years after operation

FIG 7



Case II Before operation

FIG 8



Case II Seven years after operation

in all that time the flaps have not shrunk or altered in any way

Since the advent of various therapeutic measures destined to compete with surgical procedures in the removal of epitheliomata involving the eyelid, such plastic operations have perhaps enjoyed less popularity than formerly and, if one recollects the miserable results obtained by the former conventional methods, it is not surprising that there should be a temptation to utilize X-ray, radium, and other methods of less proved efficacy. It must be borne in mind that the patients here presented have not only satisfactory eyelids, but can be presented after the lapse of years as cured of their epitheliomata, whereas at the present time no similar assurances can be given for the value of the competing methods

LIGATION OF THE INNOMINATE ARTERY.

WITH REPORT OF A SUCCESSFUL CASE

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CONSIDERATION of the infrequency of ligation of the innominate artery has led the writer to place upon record the history of the following case

Mrs. K., aged sixty-eight years, referred by Dr. H. H. Webster, presented herself on January 11, 1913, complaining of severe pain about the right shoulder and in the right arm, and of a pulsating swelling above the clavicle

She had always been a hard working woman, had not been addicted to the use of alcohol and there was no history of lues nor could there be found any evidence that there had ever been a luetic infection, though a Wassermann test was not made

Her present trouble was noticed a month or six weeks before coming under observation, pain and difficulty in using the right arm being the first disturbance. Early in January, 1913, she detected the pulsating swelling

Physical examination did not reveal any pathologic condition except a moderate arteriosclerosis and the enlargement above the right clavicle. The swelling, which was about the size of a hen's egg, presented all the characteristics of an aneurism of the subclavian artery. There was no apparent disturbance of the circulation in the arm, except the pain and certain paræsthesiæ, no evidence of nerve lesions beyond what could be accounted for by the pressure of the aneurismal sac on the brachial plexus

She was at first treated by keeping her in bed, on a reduced diet, with limitation of the amount of liquid ingested and the administration of small doses of iodide of potassium

On February 6, 1913, an attempt was made to insert fine silver wire into the sac, only about 8 inches of wire could be passed, however. This was cut off flush with the skin and has of course remained *in situ*

No improvement in the local condition was effected and on February 10, 1913, she was operated upon, under ether anæsthesia.

An incision was made along the anterior border of the sternocleidomastoid down to the sternoclavicular articulation, and another one along the clavicle, the triangular flap of skin, superficial fascia and platysma was dissected up, after division of the deep fascia, severing the origin of the sternomastoid muscle and clearing away some of the loose fat, a good exposure of the aneurism and the deeper structures was obtained. The aneurism involved the third part of the subclavian artery, extending, however, behind the scalenus anticus muscle and encroaching upon the first part of the subclavian. It was accordingly deemed unsafe to apply a ligature to the first part of the subclavian and ligation of the innominate was decided upon.

The sternohyoid and sternothyroid muscles were severed and raised upward, about 2 inches of the clavicle were resected and the innominate artery was readily exposed. A heavy, braided double silk ligature was placed around this vessel, about $\frac{1}{2}$ inch below the bifurcation, and tied with an ordinary surgical knot, as the knot was being tied the coats of the vessel could be distinctly felt to give way, though only very moderate force was used, evidently the vessel wall was markedly atheromatous. Pulsation of the sac at once ceased completely. The common carotid was also tied, about one inch above its origin, with No. 2 chromicized catgut. The wound was accurately closed, except for a small drainage opening at the inner angle, and the dressings so applied as to obliterate dead spaces. The arm was wrapped in cotton. The patient made no complaint of coldness of the limb subsequent to the operation, and there was no œdema or disturbance of the nutrition. The wound healed by first intention. There was at no time any evidence of disturbed cerebral circulation. The sac rapidly became consolidated and firm. Some pain and paræsthesia persisted for several weeks.

On June 29, 1913, it was noted that but little trace of the aneurismal sac could be felt, there was no pulsation of the radial or brachial arteries, the hand was colder than the left and the skin of the palm apparently smoother and somewhat atrophic. There was some pain about the end of the clavicle, probably due to the adherent scar.

The patient was examined thirteen months after the operation and found to be in good general health, her weight has increased,

she works every day, and has no pain. No trace of the former aneurism can be felt, and the radial pulse is absent, there still seems to be some paræsthesia of the forearm and fingers. An examination of the chest fails to reveal any evidence of an aneurism of the arch of the aorta or any of its branches.

Observations on the blood-flow in the upper extremities were made by Prof G N Stewart.¹ A note from him is as follows: "The blood-flow in both hands in Mrs K is greater on July 9, than at the previous examinations (March 20 and March 21). The ratio of the flow in the right to that in the left hand is 1.13 on July 9, while at the previous examinations it was 1.35. The relative increase has therefore been much greater in the right than in the left. Immersion of the left hand in cold water causes now a marked diminution in the flow in the right, indicating that an appreciable (and no doubt the greater) part of the total resistance of the path is now in the smaller vessels of the anterior limb. The arterial channels feeding the arm are therefore now comparatively wide. The flow in the right is absolutely as great (over 8 grammes per 100 cc of hand per minute with room temperature 26 C), so that the symptoms now observed in the hand cannot be due to the small blood-flow."

As is well known, the innominate artery was first ligated by Valentine Mott in 1818. Sheen,² in 1905, collected 36 cases, including one of his own, and Burns,³ in 1908, collected 10 more cases (one of them his own), bringing the number up to 46. I have been able to find references to the following additional instances: Myles,⁴ one case unsuccessful, Saigo,⁵ two cases (successful), Ballance,⁶ two cases (one successful), Sargent,⁷ one case (successful). These, together with my own case, bring the number up to 53, of which 14 were successful (26.4 per cent). Only one of the recoveries, that of Smythe, dates from pre-antiseptic times. Tables are given by Sheen and Burns showing details of the cases up to 1908.

Allan Burns in 1811 demonstrated that the vessels of the head and the right arm could be fully injected after ligation of the innominate artery in the cadaver, and in looking over the published cases of the ligation of this vessel during life, no instances of gangrene could be found, though disturbance of the cerebral circulation occurred a number of times.

The most common cause of death has been secondary hemorrhage, which occurred in one instance as late as the sixtieth day after operation; this can be readily understood, as the majority of operations were done in pre-antiseptic days, however, secondary hemorrhage is still a large factor in the mortality record of the more recent cases.

The cases above referred to are, of course, very unequal in value for forming an idea as to the advantages and disadvantages of ligating the innominate artery and in deciding which plan of procedure is to be adopted in a given case. Most of the operations were done in pre-antiseptic times; the position and size of the aneurism was quite variable; in some a greater or lesser degree of arteriosclerosis existed; the ligature material varied; other vessels, such as the common carotid and vertebral, were frequently tied in addition; in two instances, at least, the aneurismal sac was extirpated after the ligation of the innominate for return of pulsation.

For the cure of aneurism of the right subclavian artery, which is the most common indication for the ligation of the innominate, some eighteen different operative procedures have been practised according to Jacobsthal⁸; to these may now be added the Matas method.

It is not the purpose of the present writer to discuss these methods. Cures have been accomplished by most or all of them, but it cannot be said definitely which is the method of choice. It may be noted that peripheral ligation has proven quite successful; Savariaud⁹ has collected nine cases, all followed by recovery. It is the opinion of many writers that extirpation of the sac is the ideal method; both extirpation and the obliterative method of Matas are based upon the underlying principle, established by Antonio Scarpa, that the artery should be obliterated at the site of the aneurism. However, there are cases in which these methods can for some reason or other not be adopted and ligation of the innominate, which is now established as a feasible and reasonably successful operation, will have to be resorted to.

A few details in the performance of the operation may be briefly alluded to.

To gain access to the vessel, an incision along the anterior border of the sternomastoid, joined by another over the clavicle, has been the one most frequently adopted, the flap having been dissected up, the attachments of the sternomastoid are divided and also those of the sternohyoid and sternothyroid; the common carotid having been exposed, it is followed to its origin from the innominate. Ordinarily, the bifurcation is high enough to enable one to reach the vessel without removal of bone, however, excision of the inner part of the clavicle will materially aid in exposing the vessel and in giving more room for the deeper dissection. Milton¹⁰ proposed longitudinal division of the sternum and forcible separation of the two parts in order to gain access to the anterior mediastinum; this seems to me an unnecessarily severe procedure, at any rate for ligation of the innominate. Bardenheuer recommended osteoplastic resection of the manubrium, the flap is hard to make, however, and is apt to suffer in its nutrition and necrosis may result. Removal of the right half of the manubrium and adjoining costal cartilages, and perhaps also the inner end of the clavicle, may be resorted to.

In clearing the artery injury to the innominate veins, the vagus and the pleura must be carefully avoided, and this is best accomplished by keeping close to the common carotid and innominate arteries and gently displacing the structures mentioned.

There has been considerable discussion concerning the character of ligature material to be used, the kind of knot to employ, whether to use two separate ligatures, a short distance apart, how firmly to tie them and whether or not the common carotid and other vessels should also be tied.

Provided rigid asepsis be maintained, it probably makes little or no difference what ligature material is employed, personally, I believe, that the ligature should be tied firmly enough to divide the inner coats and that the common carotid should also be tied, and perhaps the vertebral, as it is reasonable to assume that thus a return of pulsation in the aneurismal sac will be more likely avoided.

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DISTANT RESULTS OF A SUTURE OF THE HEART FOLLOWING A WOUND BY PISTOL-SHOT.*

BY ROBERT PROUST, M.D.,
OF PARIS, FRANCE.

FOUR years ago I operated on a youth, fifteen years of age, for a wound of the heart

He was able, after being cured, to return to his normal mode of living Since the operation I have never lost sight of him, as he comes to see me regularly

Lately, more than four years after the intervention, I have been able to examine with details, thanks to radioscopy, radiography and electro-diagnostics, the working of his heart These are the results I shall have the honor to examine before you; but before doing so, I think it right to give you the details of this observation:

On February 20, 1910, being on duty, I was called at 5 o'clock in the afternoon for urgent service at the Trousseau Hospital, in Dr Savariaud's ward, for a wound in the heart, diagnosis made by Messrs Bloch and de Cumont, internes of the service

On arriving, I saw a boy, thirteen years old, very tall for his age, who had been shot in the præcordial region. His condition was as follows:

At the beginning of the afternoon (at 10 minutes past 12 exactly), one of his little playmates had inadvertently pressed the trigger of a loaded pistol with which he was playing, and which fired at a distance less than one metre

The blackish orifice, where the ball entered, is easily seen inside the nipple, and a rather wide streamlet of blood flows continuously from it On auscultating, the beating of the heart is muffled but perceptible, the cardiac dulness seems to be enlarged at its basis There is no sign of hæmothorax Traube's semi-lunar space is sonorous.

* Read before the American Surgical Association, April 10, 1914

The pulse indicates about 100, but has a very bad tone, very unsteady in strength and rather undulating. The patient is extremely pale, in spite of numerous injections of serum and camphorated oil, of which the first were made by Dr. Gagnière, and which had pulled him through the great shock he had at the beginning, he is quite conscious, but is in great distress, a very acute dyspnoea, and intense thirst and a very great pain in which he called "the region of the heart." His physiognomy is imprinted with a striking anxiety. There are evidently symptoms which plead strongly in favor of a heart wound, especially the state of the pulse, but for once in a way it might be a question of simple shock. So, while everything is being prepared for the operation, I remain near the patient in order to closely appreciate the movements these divers symptoms are about to make.

After a rather long period of hesitation I have the impression of a progressive aggravation and decide on operation.

From the beginning I ascertain as far as possible the trajectory of the ball. For this, after having traced a cutaneous incision according to Fontan's rule, I lift the skin and soft parts along the border of the sternum, and find the fifth costal cartilage shattered by the ball; I raise it and come across a mass of liquid blood, which bubbles and is animated by beating, I then quickly complete the flap by sectioning the fourth and sixth costal cartilages at their sternal insertion. The turning down outwards of the flap simply by elasticity is quite easy since it is question of a thirteen years old boy. I am very careful in this turning down to unfasten and push back the pleura, it was wounded by the shot at the level of the præcordial part and the passage of the air is heard at each respiration, I cover with compresses this breach of which the walls are too infiltrated with blood to allow of suturing.

Ligature of the two ends of the internal mammary and the sectioned intercostals. I then cleanse the operative field, and after having sponged much blood and tamponed the lower part of the wound (where the blood comes from) I clearly see the forepart of the pericardium, and by transparence above it, the forepart of the heart which slides at each beating, but seems to be separated by a thin liquid sheet. I then take away the compress which tents the lower part of the wound, that is to say, the lower part of the pericardium. A spurt of blood is produced immediately and I clearly distinguish the wound in the pericardium from which it comes. I enlarge this wound with my scissors,

both from the top and the bottom, to an extent of about 8 centimetres or about 3 inches, and mark the borders of the serous membranes with forceps after having isolated the operative field.

I am thus easily able to explore the pericardiac cavity, but at the level of the base I see only blood, and cannot distinguish the point of the heart. This is caused by the fact that all the base of the pericardium is filled with a *coagulum as large as the fist, which covers the point of the heart and compresses the heart upwards*

I extract the coagulum, and with it the ball which was free in the pericardium. As soon as the coagulum is taken away the point of the heart appears freely with its pinkish white color, there is clearly distinguished a wound in the front residing near the left border quite near the point, a jet of blood escapes from it at each systole. Moreover, from the moment the coagulum is taken away, the heart begins to beat in a most immoderate manner, and it is with great difficulty that it is grasped. I am moreover troubled by the stock of instruments, for, at the beginning, I have at my disposal only a curved Reverdin's needle of the current model. It is with this that I quickly make my first stitch which perforated totally the wall of the heart, once knotted it stops the hemorrhage a little, but blood escapes along the thread. From this first stitch I am able to make three others non-perforating, by using this time the small Reverdin's intestine needle. I hide the first set of transversal sutures by a second plan of superficial sutures. I then turn the heart upwards to look for a second wound on the posterior face but I find none. But seeing the descendent obliquity of the traject of the ball, I come to the conclusion that it is a tangential wound although a penetrating one.

Suture of the pericardium with separated stitches of catgut. No. 0. The lowest stitch fixes a very small rubber drain, which is level with the serous membrane and even penetrates into it at a little less than a centimetre, the drain has a vertical traject and comes out again in the lower horizontal branch of the cutaneous incision near the sternum. This drain was used on account of the relatively long time between the accident and the operation, and also on account of the finding of the bullet in the pericardium.

The flap is turned back (without suture of the pleura, which I find too infiltrated), and as I fear the edge of the lowest rib might wedge the drain, I protect the latter with a little tent of about 3 centimetres long, not going so far as the pericardium.

Reunion of the muscular surface with catgut. Fish-gut for the skin. Subcutaneous serum during the whole of the operation.

Operative Consequences.—Immediately after the operation the patient is taken back to his bed, in appearance hardly the worse for the operation.

The next day, February 21, there is a considerable thermic reaction. In the morning 39.8° Centigrade, that is about 103.6° Fahrenheit, and in the evening 40.4° Centigrade, or about 104.8° Fahrenheit.

In spite of this the general status is not alarming, the pulse indicates 110.

The following days there is a slight fall in the temperature which, however, remains very high.

On the ninth day, ablation of the small tent joined to the drain, immediately after this follows the escape of a reddish serosity, non-purulent, and of which the rhythmical flowing is isochronal to the cardiac beating (at this moment the temperature is about 102° , but the general status, which remains good, continues to disagree with this temperature).

Pulse indicates 96.

March 2 and 3—Same status.

March 4—The oozing tinged with blood which followed the ablation of the tent has stopped, the patient has a little chill, and in the evening the temperature is 104° .

March 5—Messrs Proust and Perinaud examine the patient in the evening, the pulse is very undulating, of very feeble tone and indicates 120. The heart-beats are exceedingly dull on auscultating, the patient has some trouble in swallowing, which has increased since the operation. Briefly, there are evident signs of pericardiac effusion. The small rubber drain, however, produces nothing. It is still solidly fixed in the depth and oscillates with the cardiac movements, I pull it away with a sharp tug and immediately out flows a great abundance of blood-stained serosity which is in no way purulent. The hand which palpates the radial pulse feels that little by little it puts itself right from this moment. It becomes pronounced, excellent, very strong.

From this moment the effervescence begins to cease, and finishes in less than 48 hours. The patient leaves the hospital on March 21, 1910, cured, one month after the operation.

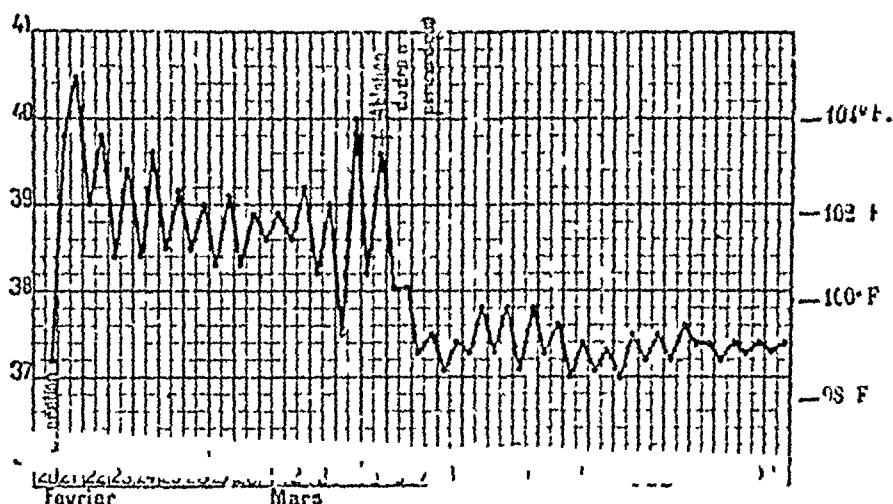
Examination on leaving the hospital. Temperature normal, pulse 80, the beating of the heart seems normal, the troubles of

swallowing have totally disappeared as well as the rising of the stomach which attended them.

The patient was presented at the Société de Chirurgie at Paris on April 13

Immediately after his departure from the hospital, on March 21, 1910, he was engaged as telegraph messenger at the Post Office in Paris, and able to return to his normal mode of living

FIG 2



Graphic

He followed this calling of telegraph messenger during three years, and in spite of the fatigue experienced in climbing long staircases, he did not show any functional cardiac troubles, at the most did he notice, in the beginning, a little panting after hurrying upstairs. Since a year ago he has changed his profession. He is now a book-keeper and complains of no trouble whatever. Having his address I asked him if he would be examined in order to see if, a long time after the operation, our means of investigation would show, in spite of the total absence of functional disorders, anything abnormal, either at the level of the cardiac suture properly speaking, or as remains of the pericarditis he had shown.

With this aim I asked my colleague and friend Dr. Bezaçon, chief physician at the Charity Hospital, to be good enough to consult him, Dr. Aubourg, chief of the Radiology Service at the Boucicault Hospital, to kindly radiograph him, Dr. Bourguignon, chief of the Laboratory of Electricity at the Salpêtrière Hospital,

FIG. 1



Intrapericardiac clot and bullet extracted from the pericardium

100



Radiograph

to be kind enough to trace out his pulse, and Dr. Boulle, chief at the Marey Institute, to be kind enough to take his electrocardiogram.

The auscultation and electrocardiogram have established that the working of the heart was almost normal. But the point of the heart seems a little too near the sternum and the electrocardiogram shows a double bracket at the time of the ventricular contraction. The radiosopic examination has shown us very slight modifications consecutive to the sutures.

Here are the notes kindly provided to me by Dr. Aubourg

Radiologic Examination—The examination of the frontal region of the heart shows

The left auricle has a normal aspect and volume.

The right ventricle has also a normal aspect

The part of the left ventricle which forms the left border of the heart presents a normal shape, at the union of the external $\frac{2}{3}$ and the internal $\frac{1}{3}$ of the left border at the height of the fifth rib, is seen a permanent notch, which seems to be a fixed point which does not participate in the beating of the left border, as if at this level there were something which restrains the left border, such as retracted adherence. Moreover, below this notch, is seen, on the left ventricle itself, a circular zone of $\frac{3}{4}$ inch diameter, and which, by its clearness, shows up on the deep color of the remainder of the ventricle.

Afterwards, on practising divers oblique examinations, in order to judge the status of the left auricle and the posterior part of the left ventricle, it is seen that these cavities are neither deformed nor dilated.

The nature of the mark seen on the forepart is interesting to note, this might be an adherence of the pericardium, but one would not understand why the subjacent myocardium should not have preserved its thickness, so I believe it is question of an abnormally thin state of the myocardium following a scar, for example.

The second part of the examination bears on the œsophagus, the patient is placed in an oblique position, in order to distinctly see the clear space which exists between the vertebral column, the aorta and the heart.

The patient has absorbed a milk of carbonate of bismuth, the bismuth has designed an œsophageal duct of normal aspect as far as the origin of the large vessels. From this place, as far as the diaphragm, that is to say, over nearly four inches, we have seen a diminution of size of the duct, which can be estimated at a half of the normal calibre. When the bismuth got to the cardia we ascertained antiperistaltic movements several times and these movements are caused by a parietal lesion of the œsophagus. These are two objections against the supposition of a lesion of the internal tunic: first, the absence of dilatation above the stricture, second, the regularity in the diminishing of light, whereas in the lesions of the internal tunic there exists an essentially irregular canal.

We may, therefore, think that it is question of lesions of the external tunic, perhaps by adhesences to the pericardiac pouch in relation with the auricles

What does this examination prove?

That there incontestably remains some œsophageal troubles connected with pericarditis and that, on the other hand, there persists either a slight weakening of the cardiac wall at the level of the scar, or perhaps a pericardial adherence at this level

These declarations obtain their value from the agreement of the two phenomena observed by Dr Aubourg: first, the œsophageal troubles and the cardiac zone being lighter and more immovable, corresponding to the troubles of swallowing that the patient had experienced after the operation, second, to the precise passage of the bullet which had shattered the fifth costal cartilage

The radioscopic ascertainings have indeed been established by Drs Aubourg and Lebon, who were absolutely ignorant of the exact level of the wound in the heart and the troubles in swallowing that the patient had experienced after the operation

Pericarditis continues to be the great obstacle to the perfect cure of wounds of the heart. In this particular case I willingly attribute its origin to the sojourn in the pericardium, during a prolonged time before the operation, of the bullet, which, it appears, not having a very considerable speed, might easily have got contaminated from the contact of the clothes or dragged a particle of dirt with it. It was, in any case, a very attenuated pericarditis, because the serosity was in no way purulent and the simple evacuation brought about the cure

Although not a partisan of drainage in heart wounds, I believe that in this particular case, the fixing of a small rubber drain in the very orifice of the pericardium enabled us, if not by its presence, since it disappeared immediately, at any rate by its ablation, to obtain the result which would not have been obtained without it, except by a paracentesis of the pericardium. I believe there would be great interest in submitting to radioscopic and radiographic examinations patients who have been operated on for heart wounds, and by such, we shall get to know in precise manner the exact value of distant results

A REVIEW OF NINETY-NINE ARTHROTOMIES FOR FRACTURE OF THE PATELLA.*

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TWENTY years ago our societies were discussing the justification of the open operation for fracture of the patella much as we are to-day considering the operative treatment of fractures of the long bones. It was then argued that the dangers of a stiff joint following the operation were so great that a patient had better accept a partially crippled joint with ligamentous union of the patella than to risk a stiff knee following the operation.

No less an authority than the late Dr. William T. Bull took this ground. Surgeons generally are now agreed that immediate operation on the patella is entirely right and proper, but we are still divided in regard to the other fractures.

If we can convert a simple fracture of the patella into a compound one and at the same time expose the great knee-joint filled with fluid and clotted blood, without great risk, why should we hesitate to expose other fractures? The answer is, that in the treatment of the long bones we are influenced not by the fear of sepsis, but rather by the knowledge that satisfactory bony union, without operation, so generally results. The patella we know seldom can heal by bone because of the frequent interposition of fascia between the fragments.

As having some bearing on the question of the dangers of exposing fresh fractures to operation, I herewith present a review of cases of fracture of the patella, personally observed by me. The majority of the cases were operated by myself, while some were operated by my associates in the hospital service.

There were 101 fractures of the patella, and, with two exceptions, they were all subjected to the open operation.

One exception was a young woman of twenty-three, in whom, by indirect violence, the left patella was fractured transversely. After the accident she was able to stand, but not to walk. In this case the patient was very thin, the two fragments could be

* Read before the American Surgical Association, April 10, 1914.

distinctly felt, and crepitus could be easily elicited. The separation of the fragments was very slight. We felt that in this case the tendinous expansion of the vasti muscles had not been torn and that there was a fair chance for good union. There was also decided opposition on the part of the family to operation. The limb was placed on an inclined splint and the fragments held together by adhesive plaster placed about the fragments. The result was very satisfactory. A year later the opposite patella was broken, and although the separation of the fragments was greater, operation was not performed because of objection by the family. In this case the result was satisfactory, although at the end of six months there was some separation of the fragments, about half an inch. A year later this had not increased. She was able to walk perfectly well without aid. Seven years later the condition had not changed.

The other was a man over seventy years of age, who obtained a satisfactory result from similar treatment.

The operation has been performed within the first 48 hours after the injury, except in a few cases in which it has for various reasons been delayed to a later period. The operation has not varied except as to the skin incision. At first we made a straight longitudinal incision over the centre of the knee, but found that it did not give quite as good access to the lateral tears as did the curved incision across the joint. Our incision now begins on the inner side just posterior to the centre of the inner half of the knee and on the line of the joint, and is carried upward in a curve, passing about half an inch above the patella and then downward to the outer side of the joint to a point opposite the beginning. The flap includes the skin and all structures down to the patella tendon. This flap is dissected down to below the lower edge of the patella and gives a good exposure of the fracture and of the joint, and also what we consider most important, of the tear extending down on either side of the joint through the tendinous expansion of the vastus muscle. This tear is caused, in most cases, by the patient's efforts to walk after the patella has broken.

After all clots and fluid blood have been carefully sponged away, the fractured ends of the bone are thoroughly freshened and exposed by dissecting off that portion of the patella ten-

don which has dropped down and become adherent to the rough ends of the fragments. This we have never failed to demonstrate. We use for sutures chromic catgut No. 2. The first sutures are placed close to the edges of the fracture on either side. These are not tied until the rents in the lateral portion of the capsule have been accurately repaired. The first sutures are then tied so as to bring the posterior edges of the fracture together. If, when these sutures are tied, the anterior edges are separated by an eighth of an inch or more, we are better satisfied because then we are sure that the tying of the anterior sutures will surely give closer apposition of the fragments. The next suture is a sort of mattress suture. It is placed crosswise through the patella tendon above the upper fracture and then carried across the tendon below the lower fracture and tied. The effect of this is to take the strain from the transverse line of sutures during the recovery from the anæsthetic, when the great quadriceps muscle contracts. A final row of sutures is placed in the anterior layer of the tendinous expansion over the bone; the skin sutured with interrupted silk-worm-gut or continuous silk sutures. No drainage is employed.

The extremity from the toes to the upper thigh is placed in a plaster cast. This splint is left in place for ten days, it is then cut down on either side and the anterior half removed, leaving the posterior half as a permanent splint. At this time the sutures are removed and the patella grasped between the fingers and moved laterally. This movement of the patella is repeated every four or five days until the end of the third week, the patient being allowed in the wheeled chair after the second week. At the end of three weeks the cast is again removed and passive motion begun in the joint. The splint is then removed every night while the patient is in bed and re-applied in the morning. This allows of passive motion on the part of the patient when there can be no strain on the callus. If the patient resists the efforts of moving the joint to at least 45 degrees by the end of the second month, he is given an anæsthetic and under complete muscular relaxation the joint is forcibly bent to a right angle. There need be no fear of refracture in doing this, provided complete muscular relaxa-

tion is first obtained This procedure is usually successful in bringing back a rapid return of the motion of the knee.

We advise our patients to use the posterior splint while walking for at least three months After the second month while sitting in a chair we encourage them to have the splint removed and allow the leg to bend as much as possible.

In a few cases where the patient was exceedingly muscular we have used silver wire, believing that it would be better able to stand the strain of the muscular pull when the patient was recovering from the anæsthetic In this we have been disappointed, for in two cases X-rays taken shortly after the operation showed the wire broken We now use the mattress suture in the tendon, as above described, with satisfactory results

In one case of refracture in a very muscular man, we made use of the Malgaigne hooks to hold the bone during the first week In this case separation was quite wide and the hooks were found a very convenient way of bringing the fragments together and holding them during the suturing

The following is a summary of our cases

No of patients	Variety of fracture	No of fractures
72	Simple of one patella	72
3	Compound of one patella	3
3	Simple of both patellæ at the same time	6
3	Simple of both patellæ at different times	6
2	Simple of the same patella twice	4
2	Simple of the same patella three times	6
1	Simple twice and compound a third time of same patella	3
1	Simple of both patellæ at different times, with refracture of one	3
<hr/> 87		<hr/> 103

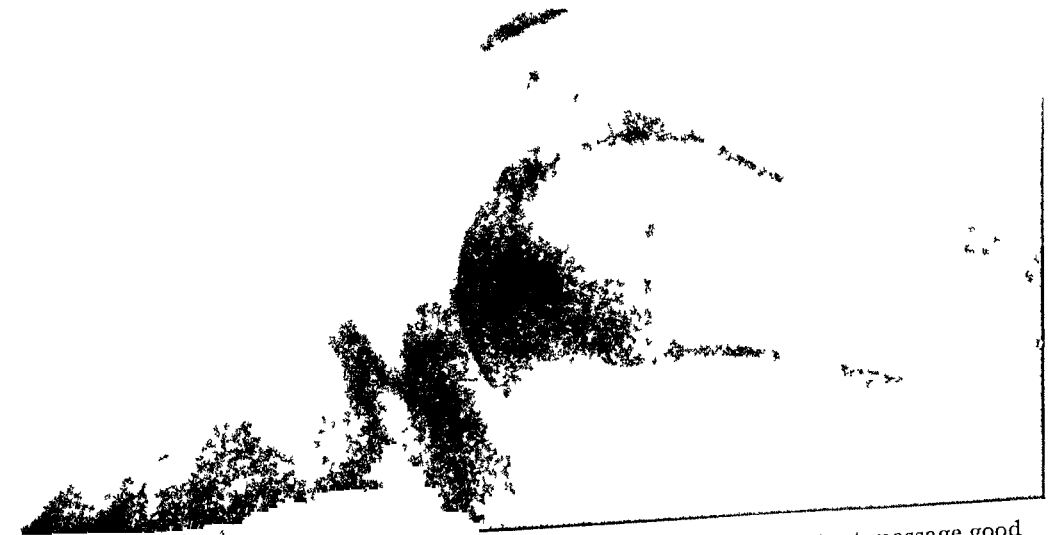
There were 99 operations All recovered from the operation Two died while in the hospital, one on the twenty-first day of delirium tremens and one on the one hundred and twenty-seventh day of pulmonary tuberculosis In both cases the anatomical result of the operation was satisfactory

A number of the fractures were multiple, the bone being broken in from three to six fragments This did not seem to make any difference in the result



Left knee Operated July 1911. Total relief, no complaint since

Fig. 2

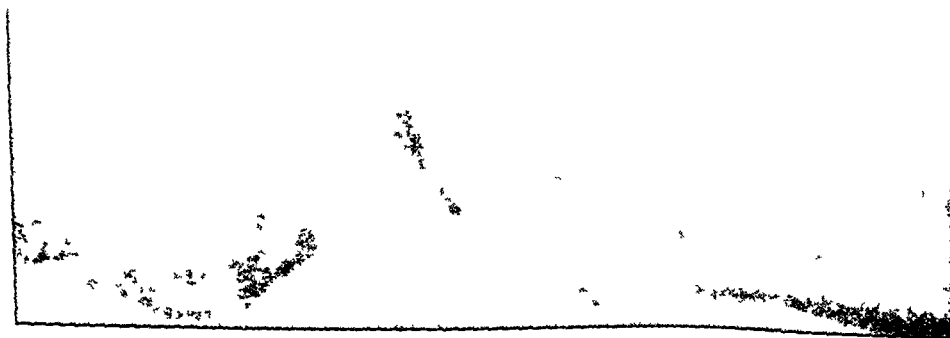


Left knee Operated March 1911. Rheumatic patient, but by persistent massage good flexion was obtained

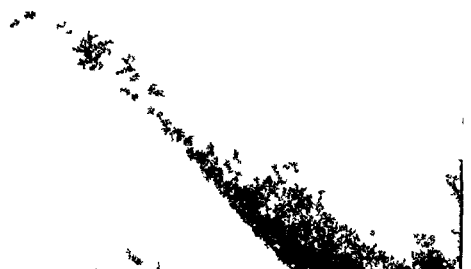


Left knee operated August 1909 Function of knee normal

FIG. 4



Compound fracture Operated January 14 1914 Good union Motion still limited
but improving



Right knee Operated November 1912 Perfect function Simultaneous direct fracture of both patellae with fracture of fifth cervical vertebra and paralysis of left arm (see Fig 7)

FIG 7



Left knee Operated November 1912 Perfect function Simultaneous direct fracture of both patella with fracture of fifth cervical vertebra and paralysis of left arm (see Fig 6)

FIG 8



Operated February 14 1914 Good union Motion in joint just begun

THE NEW DRESS OF THE ANNALS

ANNOUNCEMENT FROM THE PUBLISHERS

OWING to the continually increasing amount of material of value, offering for publication in the ANNALS OF SURGERY, the publishers have found it necessary beginning with the July 1914 issue to enlarge the size of the page and also to somewhat reduce the size of type in which the original contributions have heretofore been printed. The enlarged size will also enable the publishers to make a better display of the illustrations which are such an important feature of the ANNALS OF SURGERY's contributions.

Thirty years ago, when the first number of the ANNALS OF SURGERY appeared, the size and style then shown suited admirably. At that time a single number contained only 96 pages. They have continued to increase each year until now the average number of pages to an issue is 164. Special issues have been published in which the number has been increased to over 300 pages, with the result that the manufacturing of the Journal in the former style is not only extremely difficult but the finished product is unwieldy and cannot be read with the ease and comfort which is due a subscriber. In fact, it required constant pressure on the pages to keep them open.

We believe the new form overcomes this inconvenience and enables us to give the reader more material and greater comfort while reading than it could have been possible for us to present in the former size.

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THE EXPERIMENTAL STUDY OF INTESTINAL OBSTRUCTION.

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THE purpose of this paper is to correlate and summarize the work done in the Hunterian Laboratory of the Johns Hopkins University on certain aspects of the problem of intestinal obstruction, and to place the data thus obtained before a clinical audience. Frequent reference will be made to papers appearing in other publications of a somewhat different character from this, in which papers there are full reports of experiments performed and references to the literature of the subject. For this reason the present article will be devoted to a consideration of the general facts discovered and the inferences deduced therefrom, with but an outline presentation of the detailed evidence upon which these facts and inferences are based. Those desiring a closer study of the minutiae will experience no difficulty in obtaining the articles referred to.

In the *Johns Hopkins Hospital Bulletin* for June, 1912, the authors of this paper published an article entitled "Intestinal Obstructions, A Study of the Toxic Factors." This paper dealt with a series of experiments conducted upon closed loops high in the intestinal tracts of dogs. It was discovered that when one ligates the duodenum just aboral to the pancreatic duct and again at about the point of emergence of the duodenum into the jejunum, death rapidly ensues, usually in 24 to 60 hours, although the continuity of the alimentary canal be restored by gastrojejunostomy or other operations for short-circuiting the occluded loop. Based on this funda-

mental finding a series of experiments was conducted to ascertain, if possible, why dogs with these high closed loops died. Thus the loops were washed before closing them and left empty. The ligatures were so placed that the secretions from the stomach, liver and pancreas could not gain access to the closed loop. In this manner it was believed that substances arising from food products, bile, gastric or pancreatic juice could be excluded as probable sources of the fatal results. The entire removal of the loop in question did not in any way interfere with the health of the animals. The ligations of the loop were executed in such a manner as to avoid any considerable disturbance of the circulation. From these experiments it was concluded that death was not due to the impairment of a part of the bowel necessary (*per se*) to life, nor was it due to any factor dependent upon the circulation of the bowel.

The symptoms of the dogs in the post-operative period were quite characteristic. The dogs soon showed that they were sick. They refused food, often vomited, and had every appearance of being intoxicated. A noticeable dulness and apathy began to develop. Slight muscular tremors commenced. The gait, especially of the hind legs, became staggering and ataxic. Weakness and muscular tremors rapidly increased and the pulse became very weak and thready. Near the end there was a marked fall in blood-pressure, a subnormal temperature, and great prostration. There seemed to be no pain.

The autopsy findings present a very uniform picture. Thorax, heart, and lungs are negative. Spleen, pancreas, kidneys, adrenals and blood-vessels are normal except for congestion. There may be a slight amount of dry plastic peritonitis over the closed loop and its adjacent loops. The liver may show some congestion and in some cases a little fatty degeneration. The closed loop is practically the only structure that deviates from the normal. It contains a greater or less amount of fluid, its walls are often mottled with purple areas of hemorrhage, and stippled with grains of fibrin. There may be areas of necrosis in the wall and in some cases these have

led to perforation. The fluid in the loop is very characteristic, of a dirty slate or dull red color, about the consistency of thick soup, and often containing considerable mucus, blood, and desquamated epithelium. The material may be dry, pasty and like butter, but of slaty color. The mucosa of the loop may be normal or show a little diffuse reddening, or may be specked with ecchymoses and show shallow ulcers with red swollen margins. Microscopic examination of the organs shows only occasionally fatty degeneration of the liver. The duodenal loop may show acute inflammatory reaction, especially about the ulcers when these are present. In many cases, however, the mucosa is quite normal.

From a consideration of the manner of death just described, we assumed that the dogs were the victims of an intoxication, and that the toxic material originated within the loop. To test this assumption the fluid accumulated within the loops was carefully studied. The detailed experiments may be found in two papers published by the present writers in the *Journal of Experimental Medicine*, vol xvii, No 3, 1913. The fluid was usually digested for days at 38 degrees C, heated for one-half to one hour at 60 to 70 degrees, centrifugalized, and filtered through a Gooch crucible or porcelain perforated funnel. It was then administered to normal animals usually intravenously, and the effect observed with kymographic readings. There is usually a rapid profound fall in blood-pressure, followed by a rise to normal, and then a prolonged secondary fall to one-half or one-third of normal, if a lethal dose of poison has been given. The temperature falls, the pulse is scarcely palpable and there are conspicuous muscular tremors. Vomiting and profuse diarrhoea occur in cases where fatal doses have been given and the watery stools are blood streaked. Respiration becomes very slow and deep some time before death. Small amounts of the concentrated duodenal fluid may be sufficient to cause death within three to five hours, but the fluid varies in toxicity. At autopsy dogs killed within three to ten hours by injection of the fluid present characteristic findings. The blood remains fluid much longer than normal and clotting is

slow The liver, spleen, and mesenteric vessels show great engorgement The gastro-intestinal tract shows the most striking changes There is a moderate congestion of the mucosa of the cardiac portion of the stomach, but that of the pyloric end remains pale About one centimetre below the pylorus there is a sharp line of demarcation separating the pale mucosa from the deep purple velvety mucosa of the duodenum The duodenum is relaxed, usually contains fluid and its engorged mucosa is coated with thick mucus The jejunum presents a similar picture, but the intensity of the color usually fades to pink in the lower ileum The large intestine shows some congestion of its mucosa and ecchymoses are not infrequent On microscopic examination, there is found great engorgement of the capillaries in the villi and no other change except occasionally some escape of red cells into the tissues These findings are also encountered when the duodenal fluid is introduced into the peritoneal space of normal dogs, or subcutaneously instead of intravenously, except that death ensues some hours later, due no doubt to slower absorption

It is quite evident from the facts just presented that the supposition of a poisonous substance or substances existing within these closed loops is correct There are but two readily conceivable sources from which such a toxin might arise, the secretion of the mucosa of the duodenal loop or the activities of the bacteria present It is of course possible that these two factors are both necessary and that their mutual interaction is the essential thing In order to determine if possible which of these factors, if either, could be eliminated, repeated attempts were made to render the loops sterile without injury to the mucosa All of these experiments failed to produce the condition desired The other side of the problem was then attacked, and successfully That is to say, by washing the loops with a four per cent solution of sodium fluoride the mucosa was practically entirely destroyed, whereas bacterial growth continued unchecked The fluid collected in such a loop did not possess the toxic properties on injection into normal dogs that were detailed above In short the removal of

the mucosa renders the formation of the toxin impossible and shows conclusively that it is essential to the development of the phenomena characteristic of these closed loop experiments. Further evidence will be adduced below to show that the intoxication following such closed loop experiments is due to changes in the mucosa itself and while not clearly understood as yet, are perhaps best described as due to a perverted physiological activity of the mucous membrane. That bacteria may play a rôle in instituting this perversion cannot at present be denied.

We have shown that when closed loops of the type under consideration are made, death results, and that in the loops there accumulates a toxin. Further, the source of this toxin is the mucous membrane of the loop. Does the toxin cause the death of the animal, or is it simply a collateral and not a causal phenomenon in the chain of development leading to the fatal termination of these experiments? At once the suggestion presents itself that an enterostomy into the closed loop, affording external drainage for its contents, might throw light on this point. Numerous experiments of this type were made, the loop being closed as usual, but then pulled up into the wound and opened so as to drain freely. Very interesting results were obtained. It is quite possible by such means to keep the animal alive for weeks or months—indeed, so far as we know, indefinitely—in favorable cases. And in all cases life is somewhat prolonged beyond the maximum period attained with the undrained loops. This would seem to show the intimate relation between the absorption of the loop poison and the death of the animal. The same relation is indicated by the similarity of symptoms in dogs dying from closed loops and those dying from the injection of loop toxin. We feel that it is safe to assume that the toxin described is really the active factor causing the death of animals with the duodenal loop. Parenthetically, it may be said here that other parts of the intestine have been studied to some extent by ourselves and in more detail by others, notably Bunting and Jones, *Journal of Experimental Medicine*, July, 1913. It is the

general finding that the disturbances are most pronounced following the formation of loops in the duodenum and high jejunum and become markedly less as one approaches the colon.

Having concluded that the mucosa is primarily the source of the substance responsible for the intoxication, attention was directed toward a study of the mucosa itself. Repeated experiments showed that if the mucosa of a closed loop be carefully washed, then scraped off, and allowed to autolyze in normal salt solution in a thermostat for twenty-four hours, then treated as the loop contents were treated (described above) and injected intravenously into healthy dogs, it gave evidence of the loop toxin. In other words the toxin is not only in the lumen of the bowel in these cases, but in the cells of the mucous membrane itself. Furthermore, in the majority of dogs in which loops were drained, death occurred within five to eleven days, and the mucosa from these loops treated as just described also showed the presence of the toxin. (Why some dogs with drained loops die and why others survive will be considered later.) On the other hand ample experimental evidence has shown that the mucosa of the duodenum and jejunum of normal dogs, when treated in the same manner—washed, autolyzed, and injected as above—does not affect the animal in the least. Further information has been obtained in the same matter by Davis, working on certain phases of this general problem in this laboratory. In the *Johns Hopkins Hospital Bulletin*, February, 1914, he reports a study of the secretion of the normal mucosa of the duodenum and jejunum in dogs. This secretion was collected in dogs with no obstruction, but the bile and pancreatic secretions were excluded from the bowel. Duodenal secretions collected in this way, and as nearly normal as the conditions of the experiment would permit, were found to contain the toxin, with characteristic properties.

To summarize this rather confusing array of facts the normal mucous membrane does not itself contain a demonstrable amount of toxin, but apparently under certain conditions does secrete it, whereas the mucous membrane under

conditions of obstruction not only excretes the substance into the lumen of the bowel but also retains it within its own cells. Admittedly, we are unable to define more accurately the term "obstruction conditions." It does not mean simply retention of material in the lumen. Further, Davis, in the paper referred to, has proved that absorption, as tested by easily recognizable substances, is no better from within a closed loop than from the unobstructed lumen of normal gut—if anything, indeed, not quite so rapid. Hence we feel that the toxin within the cells of the mucosa and not that poured out into the lumen of the gut is the chief source of the systemic absorption and intoxication. There are many theories that may be advanced to account for the presence of the toxin in these cells—disturbed neurotrophic control, absence of normal mobility of the bowel wall, altered interaction of the various ferments and enzymes, etc.—that furnish a field for further research. For the present we must be content to say that under "obstruction conditions" there occurs a perversion of the physiology of the mucosa that leads to a retention or elaboration of toxin within its cells, and from this source comes the systemic absorption and intoxication.

The position taken by us, namely, that death in these cases is due to a toxin elaborated within the mucosa and absorbed from it, has not met with universal acceptance by those working in the same field of investigation. Hartwell and Hoguet (*American Journal Medical Sciences*, 1912, cxliii), in a series of experiments with simple obstruction in dogs, instead of isolated loops, showed that the animals undergo a great loss of fluid from vomiting and that life can be prolonged until starvation terminates it by supplying this deficit in water. From this and other facts they conclude that dehydration is the principal factor in producing death in simple obstruction. We do not claim that the isolated loops are identical with the simple obstructions encountered clinically. This form of attack on the problem of obstruction was chosen because it permitted the elimination of many of the possible factors that enter into simple obstruction, all of which cannot be properly

valued when complicating each other. Having found the existence of the toxin above referred to in the loop experiments, it becomes relatively an easy matter to discover whether it exists in simple obstruction cases as well. Material obtained from several cases of human obstruction, as well as from simple obstruction experiments in the dog, has led us to believe that the toxin does exist in these cases as well as in the loops. The exact relation between the two conditions, as well as the direct bearing of our experiments on the clinical problems of intestinal obstructions, will form the subject matter of a paper now in process of preparation by the present writers. Hartwell, in a recent article (*Journal of Experimental Medicine*, August, 1913), has undertaken a critical review of the work published by us on the closed loops. He admits the existence of the toxin and its causal relation to the death of the animal, but quotes from our protocols of experiments to show that the degree of intoxication is proportionate to the amount of injury and necrosis shown by the mucosa of the isolated loop at autopsy. From this he concluded that the toxin with which we have been working is not dependent upon obstruction conditions at all, but upon insult to the mucosa, and that in a simple obstruction without any lesion to the membrane of the gut no poison would be evolved, hence the toxin formation is merely incidental to the obstruction and not the primary cause of death, which he still maintains to be desiccation with concomitant tissue changes. Our best answer to this chain of reasoning is to refer to numerous experiments quoted in detail in the articles already referred to, in which closed loops resulted fatally and showed a rich toxin content both of the mucosa and the loop fluid, but in which no gross or microscopic lesion of the mucous membrane other than a moderate hyperæmia was discoverable. So often is this the case that we do not feel that demonstrable damage to the mucosa plays any essential part in its propensity to form the toxin.

We have throughout the work on this subject used the general term toxin to designate the substance or substances obtained from the isolated loops in the manner described, and

recognizable by the characteristic physiological properties. This vagueness of terminology is necessary because we have as yet been unable to obtain any accurate idea of the chemical nature of the substance or to secure it in anything like a condition of chemical purity. Certain of its properties we know. It can be heated without destruction for long periods at 60 to 70 degrees C. but boiling fresh fluid precipitates it by adsorption with other substances present in the fluid. Autolyzed fluid may be boiled without destroying the toxin. Prolonged bacterial and pancreatic digestion does not affect it.

Irrespective of the exact chemical nature of the substance causing the death of animals with high loops, the uniformity of its physiological effects suggested the possibility of developing a resistance or immunity against it. This suggestion has led to the working out of one of the most interesting aspects of the general problem, the detail of which, with full protocols of experiments, will be published shortly by the present writers (*Jour. of Experimental Medicine*, February, 1914). In this place we shall merely outline the results obtained. It was found possible by repeated injection of sublethal doses of toxin in increasing amounts into healthy dogs to produce a marked resistance in such animals so that they could successfully withstand much more than a known fatal dose of the injected material. A study of dogs so immunized revealed the fact that the serum possessed no protective powers, but that parenchymatous organs, notably the liver, were apparently the site of the defensive adaptations. Thus aqueous extracts of liver from immunized dogs, when mixed *in vitro* with the toxic fluid, rendered the latter inert after autolysis for several hours. A similar power is exhibited by extracts of spleen, lung, and intestinal mucosa from immunized dogs when autolyzed with the toxin. From this fact has come the impression that some type of cell common to these various organs, perhaps endothelium, is concerned in the protective phenomenon. Extracts of liver from normal dogs may possess this property in slight degree. The idea at once suggested itself that the extract of immunized liver be tried on dogs suffering from the intoxica-

tion of closed loops, to ascertain whether the *in vitro* reaction could be in any degree paralleled by an *in vivo* test. Dogs were obstructed and allowed to proceed to marked intoxication when experience led us to believe that life would be terminated within a few hours. The results of these experiments will be published in detail. At this time we shall content ourselves with saying that it may be possible to prolong life by such a method. The discovery of an increasing resistance against the toxin has suggested an explanation of the results of our drained loop experiments. It will be recalled that these dogs exceed the life-period of the closed loop dogs and some have lived for long periods, others dying in five to eleven days. It is clear that the escape of loop contents by drainage eliminates a quantity of the toxin and we believe that what absorption occurs here takes place largely from the mucosa direct, without added reabsorption from material already excreted into the lumen. Hence the animal undergoes a slower and less overwhelming intoxication and has opportunity to develop some degree of immunity. The success of this defensive adaptation naturally varies with the individual animal, and thus occasionally a dog lived indefinitely, having attained a status in which it is able to neutralize the noxious product of the loop mucosa as rapidly as it is formed, whereas in other instances death is delayed a varying length of time by a defence which is inadequate, but nevertheless quite definitely observable. An interesting side-light on this question of immunity is afforded by the work of Davis, in the article previously referred to, on similar closed loops in cats. He found that cats survived much longer than dogs and finally died as a result of the distention and perforation of the loop, with consequent peritonitis. The characteristic toxin is nevertheless present and very active, killing dogs in small quantities with characteristic symptoms. The possibility of immunizing dogs suggested the idea that cats might possess a native immunity against this particular poison. The truth of this conception is borne out by the fact that Davis has failed to kill any cat even by the administration of relatively huge doses of known toxic material.

It will be observed that our experiments have been conducted upon closed loops and not upon simple constrictions of the lumen of the bowel such as are usually encountered clinically. The purpose in proceeding thus, as already explained, was to eliminate some of the complex factors that render direct study of simple obstruction too intricate a problem to control sufficiently. The next step is to determine whether the facts discovered in regard to closed loops can be carried over to apply to simple constrictions, and then to correlate our whole series of studies with the problem of clinical obstruction. It may be mentioned that a dog recovering from a simple obstruction will show a high immunity against a subsequent closed duodenal loop. The physiological properties of bowel content obtained from several cases of clinical obstruction in the human make us sanguine of proving the identity of the toxin with a toxin in clinical cases of obstruction. Whether this is the chief or only deleterious substance to be reckoned with we do not as yet know. In any case, the resemblance between our loops and certain forms of clinical obstruction, for example volvulus and the usual type of strangulated hernia, is quite apparent, and suggests that these cases present the double problem of a simple obstruction plus a closed loop. The importance of placing an enterostomy opening as close as is feasible to an unrelieved obstruction is also a corollary to our observations, as otherwise a condition resembling a drained loop may develop between the enterostomy and the obstruction. The important finding of toxin within the mucosa of the loops, even when drained, sheds light on certain clinical facts that have heretofore been obscure. It is well known that occasionally after the relief of obstruction by enterostomy or otherwise, even when peristalsis emptied out the bowel content, the patient failed to respond as one would expect and died without appreciable benefit from the drainage. If one may assume the similarity of these clinical cases to our loop experiments, it is easy to see an explanation in continued absorption from the mucosa, in a patient already so intoxicated that this continued absorption was sufficient to overwhelm him.

SARCOMA OF THE SMALL INTESTINE.*

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THE clinical and pathological aspects of sarcoma of the small intestine have been thoroughly reviewed in the comprehensive papers of Baltzer, Rheinwald, Lecene and Libman. While little can be added to their conclusions, the writer desires to report two new cases and to summarize the results of operation in the large number of cases which are now on record.

A statistical review of sarcoma of the intestine proves the rarity of the affection, as Baltzer in 1894 was able to collect 14 cases, Libman 59 cases in 1900, and Lecene 89 cases in 1904. The autopsy records in various large hospitals also confirm the view that sarcoma is infrequent in the intestinal tract, especially when compared with carcinoma. Nothnagel found 243 instances of carcinoma of the intestine in 2124 autopsies on cancer cases, while of 243 sarcomata but three were in the bowel. Smoler in 13,036 autopsies found 13 cases of primary sarcoma of the small intestine. Sarcomata of the large intestine, excluding the rectum, are much less common. Of Krueger's cases, 16 occurred in the small intestine, 6 in the large intestine and 16 in the rectum. Jopson and White, in 1901, found 22 cases of the large intestine, whereas Libman's paper appearing a year earlier contained 59 cases of sarcoma of the small intestine.

Sarcoma of the small intestine does not appear to affect any particular age, although Baltzer found that the majority of his cases occurred in the fourth decade. The 75 cases in which the age is mentioned may be divided as follows: 1-10, nine, 10-20, ten, 20-30, seventeen, 30-40, eighteen, 40-50, fourteen, 50-60, five, 60-70, two.

* Read before the Philadelphia Academy of Surgery, January 5, 1914

like that of dogs with closed loops. This toxin is believed to be the cause of death.

The toxin is formed by the mucosa of the closed loop, some of it being secreted into the lumen and some remaining within the cells of the mucosa.

If the closed loops be drained externally, the post-operative course of the animal is altered, but varying degrees of intoxication still are observable, and the presence of toxin within the mucosa of the drained loops is demonstrable.

Absorption takes place not only from the loop contents but from the mucosa direct, the latter being a quite important source of intoxication.

There are various possible explanations for the perversion of function that causes the mucosa to become a source of intoxication, but none are yet proved. The fundamental explanation of the change is as yet unknown.

It is possible by the repeated injection of sublethal amounts of the toxin to immunize dogs against fatal doses.

The parenchymatous organs, spleen, intestinal mucosa, etc., and particularly the liver, seem to be especially concerned in the production of the resistance against the toxin when dogs are immunized.

The extract of an immunized dog's liver, properly handled, will destroy the toxin *in vitro*.

We believe that the intoxication observed in closed loops is quite similar to that existing in simple obstruction, and that the same toxin is the essential agent causing death in each instance.

The discovery of the importance of absorption from the mucosa even in drained loops leads one to think that the establishment of an enterostomy for drainage in clinical cases may not meet all the requirements for successful treatment.

It may be possible to develop a method of direct defence against the toxin, as an auxiliary to the surgical relief of obstruction conditions.

connection with the question of metastasis. The majority of recurrences or metastases have arisen in lymphosarcoma or in the round-cell variety. The spindle-cell sarcoma, on the other hand, has a pronounced tendency to remain localized. This fact is explained partly by reason of the stenotic action such tumors exert on the intestine, in consequence of which the indications for early operation arise before marked extension can occur.

The association of single traumatic insults has long been held important in the development of sarcomata in general. The numerous instances recorded by Coley, Lowenstein and others support this view. It is not surprising, therefore, that such a factor is mentioned in some of the reported cases and is of particular interest, as the disease occurs much oftener in the working class. Zwalenburg records an abdominal injury in a boy aged five, six weeks later a tumor one inch in diameter was noted at the site of injury. Nothnagel observed a case of lymphosarcoma developing on the base of an old tuberculous ulcer. The association of tuberculosis and lymphosarcoma elsewhere has been observed and is regarded as an accidental association. Three cases of sarcoma have been reported to have occurred in the ileum years after severe attacks of typhoid fever. Fritsch noted an instance developing five months after an operation for strangulated hernia. Syphilis has also been present in several cases.

From these factors of more or less etiological importance, we are unable to draw any conclusions which might throw light upon the cause of intestinal sarcoma.

Kasemeyer has investigated very thoroughly the subject of intussusception caused by tumors, and has collected 284 cases, of which 85, or 30 per cent, were caused by malignant formations. Of these 85 cases, 57 were carcinoma and 26 were sarcoma. The symptoms of intussusception as seen in children, the severe abdominal pain, vomiting, bloody and mucous stools, are seldom present in intussusception secondary to tumor formation. In such cases a chronic course is pursued and the symptoms extend over months even with an

The rather large number of cases occurring at an early age is a fact of much interest. The tumor in Stern's case was present at birth and caused intestinal obstruction from which the child died. In addition to this instance, sarcoma of the intestine has been observed in children of five and six years of age for which successful operations have been performed (Power, Barling, Zwalenburg).

Any portion of the small intestine may be the seat of a primary sarcoma. The following is an analysis of 53 cases in which the part involved is mentioned. As many of the case reports merely state that resection of the small intestine was performed, they could not be included. Duodenum and jejunum, 3, jejunum, 12, jejunum and ileum, 2, ileum, 32, entire intestinal tract, 4.

All writers on the subject mention the predisposition of the male sex in intestinal sarcoma. Adding the cases which I have collected to Lecene's we find of 101 instances, 67 occurred in males and 34 in females, or practically twice as many in the male sex.

As lymphosarcoma constitutes one of the chief types of intestinal sarcoma and as such growths tend to spread early to the neighboring lymphatic nodes, the mesentery of that portion of a bowel in which the sarcoma arises is involved frequently. In 45 autopsies 34 (75 per cent) instances of mesenteric involvement are recorded by Lecene, a fact demonstrating the importance of thorough removal of the mesentery of the affected bowel. On the other hand metastasis to the superficial lymph-nodes or those in the retroperitoneum or mediastinum is rare.

Involvement of practically all the abdominal viscera has been noted in advanced cases, although the liver and kidney are especially liable to metastatic deposits. Direct extension to the peritoneum of adjacent viscera is quite common, and at the time of operation several loops of gut may require resection. Involvement of the bladder is met with frequently because the tumor in many cases occupies a pelvic position.

The histological variety of sarcoma is of great interest in

through all the coats of the gut, gradually involving neighboring coils and forming a large adherent mass. The tumor may be single or multiple, in the latter event the growths appear as plaques or small nodules under the mucosa. The single tumors, especially if pedunculated, are singularly prone to produce intussusception, although this complication has developed in the infiltrative types of tumor.

Marked variations exist in the size of the tumors, although as a rule the growth has reached considerable proportions before the diagnosis has been made or the operation performed. The shape is spindle, the contour irregular and the consistency firm in most cases.

Although partial occlusion of the bowel is present in about one-half of the cases complete stenosis practically never develops from the mere presence of the sarcoma. Even in large tumors encroaching upon the intestinal lumen, a narrow passageway can be demonstrated, thus explaining the chronic intermittent symptoms of intestinal obstruction. When complete occlusion occurs and is followed by the symptom of ileus, the condition is caused by adhesions or by an intussusception.

Sarcoma of the small intestine manifests itself in the beginning by symptoms of an indefinite nature. In the majority of patients generalized abdominal pain is first noted, this is followed by loss of appetite, nausea, vomiting, the bowels are irregular, diarrhoea alternates with constipation, and distention of the abdomen soon follows. The patients are very thin, pale and weak, when first seen. Moderate elevation of temperature and slight leucocytosis may be present. Unless the acute obstruction is due to kinking of the intestine or to an intussusception, complete constipation is unusual, although repeated attacks of obstinate constipation may be complained of. Baltzer and Nothnagel both asserted that apart from complications, sarcoma of the intestine does not produce symptoms of stenosis. This view has been disproved by subsequent articles, in which it has been shown that at least 55 per cent of the cases do have symptoms indicative of some degree of in-

intussusception present, as is demonstrated by the dense adhesions about the bowel or by extension of the invaginated tumor to the intestinal wall with which it comes in contact. The infrequency of complete obstruction following tumor intussusception is explained by the fact that the infiltrated intestinal wall undergoes dilatation.

Tenesmus may be the chief symptom complained of, but is as inconstant as is meteorismus and abdominal tenderness. The presence of a sausage shaped tumor, the situation of which varies, along with other symptoms of chronic intestinal obstruction, has been regarded as distinctive of tumor invagination by several observers, and the diagnosis correctly made (Ewald, Kasemeyer).

Many varieties of sarcomata have been observed in the intestine, the 99 cases in which the type is mentioned are divided as follows: Lymphosarcoma, 34; round-cell sarcoma, 43, spindle-cell sarcoma, 13, fibrosarcoma, 3, mixed-cell sarcoma, 1, myxosarcoma, 2, myosarcoma, 2; melanotic sarcoma, 1.

The lympho- and round-cell sarcomata greatly predominate. Many cases diagnosed as round-cell sarcoma probably belong to the lymphosarcoma group, but the histologic descriptions are too incomplete and indefinite in many cases to make the classification correct.

The tumors in the majority of cases originate in the submucous tissues (lymphosarcoma) or in the connective tissue of the muscularis or perivascular region, and in some instances reach a considerable size without producing any ulceration of the mucous membrane. They may extend parallel to the long axis of the bowel, producing a gradual infiltration of all the tissues but not causing stenosis. The bowel above the area of infiltration frequently undergoes dilatation and resembles an aneurism, the lumen of the intestine, in such cases, is filled with necrotic tumor tissue, pus and fecal material. Dilatation of the intestine is seen in the round-cell and lymphosarcomata, whereas stenosis and obstruction result from the fibrosarcomata. In exceptional cases the tumor extends

dice is the first symptom (6) Cases resembling ovarian cysts (7) Cases bearing a close resemblance to appendicitis, an observation noted first by Libman and described in several reports since that time

An early diagnosis in these cases seems impossible because the symptoms are so mild and transitory in the beginning. When, however, a tumor is discovered, freely movable, producing pressure symptoms of a mild type, with the absence of severe obstruction symptoms, sarcoma of the small intestine should be suspected.

The treatment of intestinal sarcoma is of course surgical, although in inoperable lymphosarcomata benefit has been followed by the administration of arsenic. Libman recommended its use even in cases in which successful resection of the intestine has been performed.

For a long time sarcoma of the intestine was regarded as almost invariably fatal. This view is not sustained by an analysis of the cases reported in the past decade, in a large number of which many years have elapsed without recurrence since the time of operation. The vague nature of the symptoms delays operation, although a palpable tumor is almost invariably present at the time of operation and a history of a chronic intestinal disturbance can be obtained in the majority of cases.

The number of resections of the small intestine for sarcoma is 75, of these 15 are collected by Zwahlenburg, 37 by Moynihan, 6 by Lecene, 17 by Speese. There were 55 recoveries (74 per cent), and 19 deaths following operation. Nine instances of recurrence are noted, the periods varying from three months, 5 months (2), 12 months (2), 15 months. The cases in which recurrence arose in 7 instances were diagnosed as lymphosarcoma or round-cell sarcoma, thus emphasizing the malignant nature of this variety, one case of myxosarcoma recurred.

When the infiltration of the bowel is too extensive for removal or metastasis has occurred, the abdomen should be closed without further exploration. If stenosis is present some sur-

testinal obstruction, but the course is not similar to the stenosis caused by cancer of the bowel. When carcinoma produces an obstructive lesion, the course is generally a protracted one and the patient's loss of strength and weight is slow and gradual. Sarcoma, on the other hand, causes rapid loss of weight, the disease rarely lasting over a year and the average duration, according to Rheinwald, being four to five months.

A careful study of the histories of many cases shows that attacks of constipation and diarrhoea are common, although these symptoms are wanting in a small proportion of the cases. It is also worthy of note that in many instances vague intestinal disturbances are the earliest symptoms noted, and that operation performed a few weeks or months later will often reveal a larger or even inoperable sarcoma.

Blood in the stools has been present in a small proportion of the cases, and is sometimes one of the earliest symptoms mentioned.

In a few instances the patients have noted the presence of a tumor. This on examination varies considerably in size, the surface is smooth and nodular, and unless seen quite late, the growth is freely movable. Its consistency is as a rule dense and hard. In late cases metastatic nodules are palpable and the primary growth demonstrated with difficulty.

As the result of pressure of the tumor on the intestine, distention may result, and pressure on the vessels may produce ascites, or œdema of the legs, distention of the veins of the abdominal or thoracic walls, jaundice, dysuria or diminution in the amount of urine (Libman). Examination of the blood shows merely a secondary anæmia.

Libman has classified the varieties of the disease as follows: (1) Latent cases, the disease being first discovered at autopsy. (2) Cases with the clinical picture described by Baltzer, either the general symptoms, the distention of the abdomen, or the tumor being first noted. (3) Cases in which the first symptoms are due to an intussusception or other variety of intestinal obstruction or to perforation. (4) Cases resembling tuberculous peritonitis. (5) Cases in which jaun-

Human cases behave in general like animals and show similar metabolic disturbances. There are over 58 cases in the literature in which over 200 cm of small gut have been resected. The mortality is 16 per cent, which is lower than it should be, as only the successful cases have probably been reported. Metabolic disturbances in human beings bear no definite relationship to the amount of small intestine resected.

Resection of over 400 cm of intestine has been followed by recovery, while death from inanition has resulted from resection of 284, 289, 300, 380 cm respectively.

Profound digestive disturbances have resulted from removal of 192 and 204 cm of ileum.

Progress in human cases should be guarded. Apparently successful resection may, for lack of suitable compensation, succumb ultimately to a slow process of inanition. Experiments and series of human cases emphasize the fact that neither the stomach nor the colon is able to compensate for the loss of large portions of small gut.

The writer desires to express his thanks for permission to report the following cases, operated upon by Dr John B Deaver at the University Hospital.

Male, aged fifty, has been suffering with hemorrhoids for several years and for the past several weeks has complained of constipation, distention of the abdomen, severe cramps and vomiting. The constipation was relieved by enemata and laxatives, the resulting movements were as black as ink, although free blood was not noticed. He has had successive attacks of pain, tenderness and obstinate constipation. The mass was not discovered until the time of examination, seven weeks after his symptoms began. The examination disclosed a round mass in the right lower quadrant of the abdomen. The tumor is tender, regular in outline, and is movable.

Blood examination, red blood cells 4,980,000, polynuclears 70, white blood cells 9,800, lymphocytes 20, hæmoglobin 100, monoleucocytes 0, transitionals 1, eosin 0.

Examination of the fæces for occult blood was negative.

Operation—A large mass about the size of an orange was

geons advise an artificial anus to relieve the immediate and urgent symptoms

The large number of intussusceptions noted in the series is a matter of considerable interest and importance. In 14 of the 74 resections, this complication was encountered. Ten of these 14 cases recovered, 1 died immediately after operation, and 3 from recurrence. The type of tumor has no influence upon the development of an intussusception, for the complication has occurred in the round-cell, the lymphosarcoma and other forms. A pedunculated tumor may predispose to invagination, but it also follows cases in which the intestinal wall is extensively infiltrated by the tumor.

The amount of small intestine resected in the majority of cases is from 10 to 40 cm. Barclay removed 190 cm., and Storp 510 cm. of the bowel. In the former case the patient suffered from frequent and liquid stools, and in the latter no metabolic or other disturbances were noted.

The effect of the removal of large amounts of small intestine has been investigated experimentally by Flint, whose conclusions are of great importance in view of the radical measures which may have to be undertaken in some of the cases. It was found that in dogs as much as 50 per cent. of the total intestine may be removed without fatal results, and the animals may gradually return to a condition of practically normal weight and metabolism when maintained on a favorable diet under good conditions. Resections of 75 per cent. or more of small intestine may be survived, but such animals do not show a return to normal weight with the establishment of a good compensatory process.

Animals at first suffer from a severe diarrhœa, ravenous thirst and appetite, and loss of weight, from which they gradually recover until conditions may return to those of a normal animal. They remain extremely sensitive to unfavorable conditions of diet and living.

The compensatory process consists in a hypertrophy and hyperplasia of the remaining portion of the small intestine. There is no regeneration of villi or crypts.

The mass is smooth, round and slightly movable. Red blood cells 3,710,000, polynuclears 70, white blood cells 20,000, lymphocytes 23, hæmoglobin 60, monoleucocytes, 3, transitionals 4, eosin 0

Operation—On opening the abdomen a mass was found in the mesentery, in the midline, the surrounding coils of intestine were attached to it by adhesions. The coil of ileum which surrounded the tumor and the mesentery were excised and a lateral anastomosis formed. A supravaginal hysterectomy was performed for a large subserous fibroid tumor. Recovery, no evidence of recurrence three months after operation.

Pathological Examination—The specimen consists of a tumor which is surrounded by a loop of small intestine, which measures 80 cm in length. The tumor, which measures 8 cm in diameter, is situated near the base of the mesentery and is attached to the intestine for a distance of a few centimetres only. The wall of the intestine appears normal and is not compressed by the tumor mass. On cross section the tumor is soft in consistency, the cut surface for the most part is white and contains numerous reddish areas and small points of necrosis.

On microscopic examination the growth for the most part is composed of tissue containing large stellate cells. The connective tissue in these areas is of very loose texture, and contains within its meshes a homogeneous substance taking a faint blue stain. Large numbers of blood-vessels with thin walls are present. A considerable amount of free blood is found in the fibrous tissue. In addition to the stellate cells mentioned, there are many areas in which large numbers of cells are closely packed together, the cells being spindle in type, some are large, some small and many being arranged around the blood-vessels. Minute areas of necrosis are encountered, and in these situations leucocytes are found between the tumor cells. Many nonstriated muscle fibres are seen in the more superficial portions of the tumor.

Diagnosis—Myxosarcoma of mesentery

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found in the ileum about 3 feet from the ileocaecal junction. The ileum was resected with its corresponding portion of mesentery, and end-to-end anastomosis was performed. Five days after the operation the patient developed a fecal fistula, this was followed by peritonitis, from which he succumbed eleven days after the operation.

Pathological Examination—The specimen consists of 57 cm of ileum. The intestine at one area contains a globular mass 8 cm in diameter, the wall of the intestine is enormously thickened, measuring 3 cm. The section through this thickened portion shows that the intestinal mucosa is greatly ulcerated and that the lumen of the bowel is represented merely by an irregular area of ulceration through the centre of the tumor mass. At one point the lumen is almost completely occluded by the tumor tissue (Fig 1). The tumor mass, as represented by the greatly infiltrated wall of the intestine, is composed of firm whitish tissue which is completely surrounded by the serous coat of the intestine. In the mesentery several enlarged nodes having the same characteristics as the primary tumor are found.

Microscopic examination shows a very cellular formation composed of small, round, deeply staining cells, having a fairly uniform appearance. The stroma is composed of thin fibrils which ramify between the tumor cells, which extend to the mucosa and infiltrate and destroy the intestinal glands. The structure of the muscular coats of the intestine is completely obliterated by the cellular infiltration. The tumor contains very minute areas of necrosis and is fairly well supplied with new blood-vessels. The lymph-nodes removed from the mesentery show a similar involvement.

Diagnosis—Lymphosarcoma

Female, aged fifty-seven, was admitted to the University Hospital complaining of pain in the abdomen. Her past medical history is unimportant. One sister died of cancer of the stomach. Her present illness began one month before her admittance, when she was suddenly seized with agonizing pain in the abdomen. The pain was localized to the region of the umbilicus, the attacks were accompanied by vomiting. The attack lasted twenty-nine hours. The patient recovered and was well for a period of three weeks, when the pain again returned. The pain has been persistent, is constantly localized to the region of the umbilicus, the bowels are regular, there has been some distention of the abdomen. On examination a mass the size of a grape fruit is palpable in the lower and middle portion of the abdomen. The upper limit of the tumor is about one inch below the umbilicus.

THE SURGICAL TREATMENT OF ACUTE GONORRHOÆAL EPIDIDYMITIS BY EPIDIDYMYTOMY.

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ALTHOUGH in the hands of a few genito-urinary surgeons epididymotomy has become the treatment of choice in acute gonorrhœal epididymitis, it has not as yet reached as full an appreciation as the operation seems to warrant. It is an axiom of surgery to-day, that when the function of an organ is threatened by the invasion of pus-producing organisms, prompt incision and drainage are indicated.

During the past five or six years, I have been doing this operation as described by Hagnar, of Washington, on only such of those cases as have come under my care, having unusually severe pain, with considerable swelling and high temperature. In all of these cases the results were so satisfactory that I was led to the idea of applying this treatment consecutively to all the acute cases during two and a half months last summer, when I had the care of the service at Bellevue Hospital, with which I am connected.

The astonishingly happy outcome of this experiment, as far as immediate results were concerned, seems to justify a short review of the methods employed in this small collection of twenty-one successive cases. It gives me pleasure to acknowledge the assistance and valuable suggestions of Dr George F. Cahill, of the house staff, who did this work with me, and who deserves much of the credit for putting this small operation on a technically simpler basis than it has, I think, previously enjoyed. It is on account of the simplicity of this operation and its apparent freedom from risk, also the firm conviction that the course of the disease is shortened and the liability of sterility is lessened, that I am here adding a record of my experience to the list.

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In 33 per cent of the cases pus was present. The gonococcus was the only organism found. One or two catgut sutures were then used to draw the deeper structures together, and two or three silk-worm sutures closed the skin except for about a half inch opening through which the drain emerged. The time of operation was usually from five to ten minutes. A generous dressing was held in place by an Alexander suspensory.

The immediate relief from pain and the decline in temperature was the pleasing aftermath of each operation. In forty-eight hours the drain was removed and the parts so exquisitely tender before operation could be handled without discomfort.

On the fourth or fifth day the patients were allowed up, and on the fifth or sixth day the stitches were removed and the patient allowed to go out.

This form of treatment is indeed in striking contrast with the older methods, where the patient lies in bed with his scrotum resting on a supporting bridge, stretched between the thighs and surmounted by heat, cold or chemicals, wincing at the approach of attending hands and patiently waiting, while the severity of pain was dulled by anodynes, the slow restitution of the swollen gland.

It is difficult as yet to tell the end value of this little surgical procedure, which secures such immediate relief. What is radical to-day often becomes conservative to-morrow. We may hope as much for this way of dealing with acute epididymitis, for with practically no risk, it saves a deal of suffering and lost time in tedious convalescence.

It is impossible with the class of patients dealt with at Bellevue Hospital to hope for co-operation in the after-study of these cases.

The pathology of the condition as it exists and as it is dealt with expectantly is well known and equally unsatisfactory. To get the relative value of the newer way of dealing with this complication, must needs take patient and scientific study over a period of subsequent years.

In a paper read by Cunningham, of Boston, before the American Association of Genito-Urinary Surgeons in Wash-

The frequency with which this complication of a gonococcus infection occurs, its obvious diagnosis, the distracting character of the pain, the attending fever, its debilitating and often protracted course, the unsatisfactory nature of medical treatment and the considerable percentage of following sterility are all so well known and so well described in standard text-books, that there is no need for repetition here. The simple method we employed was as follows

The patient was prepared for an ether anæsthesia. Just as soon as the patient was lightly under, the operative field was sterilized with $2\frac{1}{2}$ per cent tincture of iodine, and an oblique incision, $1\frac{1}{2}$ inches long, was made downward and forward over the epididymal swelling, which in our series of cases occurred uniformly in the globus minor. With the oblique course of our incision it was possible to avoid most of the small vessels in the skin and thus get very little bleeding.

The incision was carried down to the tunic vaginalis, which was opened to the length of the skin incision and the fluid, which was usually present, drained off. The edge of the tunic was picked up on both sides with hæmostats, which acting as retractors bared the swollen and congested epididymis, its thickened fibrous covering was incised for one-half inch over the prominence of the swelling and a probe gently passed into the substance of the epididymis, in several directions. If suppuration had occurred, the pus was in this way easily found and drained off. In all cases relief of tension was effected and drainage established.

The most important element in this operation is the lack of traumatism, as the testicle is not delivered or the parts bruised from handling. In that smaller percentage of cases where the body of the epididymitis or the globus major is involved, a freer incision and possibly a turning out of the testicle will be found to be best, but the special point of this paper is to show how little of an operation is necessary in the great majority of cases, and the little excuse there is to allow these patients to suffer the pain, the slow convalescence and possibly sterility for want of a prompt decision in draining this dependent point of infection.

A wick made of rubber dam was gently placed in the substance of the epididymis, where the probe found least resistance, or into the cavity made by the accumulation of pus, if pus was present.

TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, held January 5, 1914

DR GWILYM G DAVIS, President, in the Chair

TUBAL PREGNANCY

DR A D WHITING reported the following case

L L, a white female aged nineteen, was admitted to the Germantown Hospital, November 22, 1913. Her history states that she was married when 15 years of age and that she gave birth to a normal child 3 years ago. Her menstrual history dates back 7 years. Her menses were regular but very painful and the flow was always profuse. Her last menstrual period started April 7, 1913, and lasted 4 days, being normal in every respect. There has been no vaginal bleeding or discharge of any character since that time. She began to have the nausea and vomiting of pregnancy in May and also had pains in the lower abdomen which were intermittent in character. These were similar to pains she had had while carrying her first child, although she thought them more severe. Fetal movements had been felt for more than two months before admission and had been unusually severe and painful on the day of admission. The patient had noticed practically no difference between this pregnancy and her former one and had made arrangements for her delivery in January.

At 11 A M, November 22, 1913, after returning home from shopping, she made and ate a sandwich which she says caused marked nausea followed by vomiting and retching and severe pains, of a lancinating character, in the lower abdomen. She became faint and felt very cold, weak, and thirsty. She drank considerable water, which she immediately vomited. The symptoms continuing, her physician, Dr Suthff, was called. He immediately sent her to the hospital as a case of concealed hemorrhage.

ington, last spring, of his series of cases he reported having operated bilaterally on six. Two of these patients have married and each of them has had two children. This is interesting as not only showing potency, but the fact of their having had two children is evidence that they probably did not infect their wives. Two others of these six cases showed numerous living spermatozoa in condom specimens collected at coitus, but no spermatozoa were seen in specimens collected by massage of the seminal vesicles and prostate. The remaining two had had no sexual intercourse and the specimens collected by massaging the seminal vesicles showed no spermatozoa.

With the knowledge we have at hand it seems unlikely that this operation, when properly done, that is without further destruction of the tissue than the disease has already effected, cannot but shorten the course of the pathological process and bring to the organ a better chance of ultimate recovery. Whether the organisms are recovered from the exudate which nature has produced by her processes and which we release by the knife, is of very little moment.

The real question is, do we lessen or obviate by epididymotomy that sequel of the disease, which so often leaves the testicle with the pathways of its spermatozoa blocked—in permanent bondage?

the blood twenty-four hours after admission showed a hæmoglobin of 21 per cent, red blood cells, 2,460,000, and white blood cells, 18,600. The temperature rose to 101.6° F after the operation and continued between 99.6° and 103° for 15 days, although no cause for the continued fever could be found. The wound healed without infection, the lungs remained normal; there was no cardiac complication, there was no phlebitis, there were no signs of peritonitis. Forty-eight hours after operation the patient expelled from the vagina a mass that seemed to be a cast of the inside of the uterus. With this exception, there was no uterine discharge. At 5 P M on the fifteenth day after operation the temperature was 103° F, at 5 A M on the sixteenth day, it registered 98.6° , and remained between 98° and 99° until the patient was discharged from the hospital on the twenty-eighth day after operation.

The tumor weighed, immediately after operation, 3670 grammes and measured 68 cm in its longest circumference. An X-ray picture revealed the bony structure of a well-developed foetus.

Study of the specimen after it had been opened and hardened in formalin solution gives the following findings. The gestation sac is, in part, membranous and in part occupied by a thick, friable, spongy mass, evidently placental tissue. The sac varies in thickness from 0.1 cm in the thinnest membranous portion to 4 cm in the thickest part. The foetus measures 40 cm in length. It is a well-formed female covered with vernix caseosa and in no ways differs from the usual normal foetus. The cord, which is 55 cm long, is not attached immediately to the placental area, but is inserted into the membranous portion of the sac at a distance of about 3 cm from the placental margin. From the insertion of the cord a number of large, thin-walled, tortuous vessels radiate in all directions and ultimately find their way to the placental area. Some of the vessels leading from the cord run on the inner aspect of the sac and some on the outer. One of the external vessels presents a small rupture of its thinned-out wall.

Microscopic examination of a section through the thin membranous portion of the gestation sac shows stratified fibrous structure rather well vascularized and lined internally by the amnion. There is no apparent muscular tissue in this portion of the sac.

Microscopical examination of a section through the thicker area shows typical placental tissue of the later months of preg-

On admission, the lips and conjunctivæ were blanched, the skin was pale, the breathing was rapid and shallow, the pulse was thready and too rapid to be counted accurately. Patient complained of extreme thirst, was very restless, and showed great excitement in her facial expression.

Examination revealed a large, rounded mass extending from the pubes to above the umbilicus slightly to the right of the median line. Percussion elicited dulness over the entire right side of the abdomen, present but not so marked on the left side. Vaginal examination revealed an enlarged uterus with a soft cervix. The fundus could not be distinguished, the uterus seemed to be continuous with the abdominal mass, which moved freely with the cervix. There was no vaginal discharge. No fetal movements could be felt, fetal heart sounds could not be heard. The temperature was 97° F, respirations, 48, pulse rate approximately 160. A diagnosis of internal hemorrhage was made and immediate operation advised.

Operation at 3 P. M., November 22, within 4 hours after the onset of the alarming symptoms. Under ether anæsthesia, an incision was made through the right rectus. The right iliac fossa was filled with an enormous blood clot, while clots and fluid blood almost filled the peritoneal cavity. Rapid removal of the blood allowed an examination of the tumor which presented. It was found to be a globular mass springing, apparently, from the right broad ligament and containing a hard, irregular body. It was freely movable, there were no adhesions between it and any surrounding structure. On its surface were many broad, flat ribbon-like vessels, one of which was bleeding freely but without pulsation. The tumor was attached to the right broad ligament and to the right cornu of the uterus by a short portion of the right fallopian tube, the right ovary was to the right and below, the fundus of the uterus was below and to the left, both ovaries and the left tube were apparently normal. The right tube had apparently entirely disappeared in the tumor.

The broad pedicle of the tumor was ligated and the tumor removed. The abdomen was flushed with hot saline solution and the wound was closed in tiers without drainage. Two thousand c c of salt solution were given intravenously during the operation and one-half grain morphia was administered hypodermically.

The patient reacted well from the operation. Examination of

the time of operation Fourteen cases were operated upon before rupture or bleeding had taken place

Among the cases that ruptured, aborted, or bled from the fimbriated extremity, the catastrophe occurred in 3 during the first month, in 57 during the second month, in 30 during the third month, in 13 during the fourth month, and in 2 during the fifth month In 9 cases the period of gestation was not stated

In a very limited search through the literature of tubal pregnancy, he was unable to find any reference to a termination similar to that recorded in this case In all of the cases noted, there was rupture of the sac wall, expulsion through the fimbriated extremity, or free bleeding from the fimbriated extremity without expulsion of the gestation products In this case there was a rupture of the wall of one of the ribbon-like vessels without any discoverable rupture of the sac This rupture was possibly caused by traumatism during the violent vomiting and retching, although the vomiting may have been due to the ruptured vessel and not to the sandwich, to which the patient attributed it If caused by the marked activity of the foetus on the day of the rupture, it is probable that some signs of internal violence would have remained or that the sac itself would have been ruptured Possibly the vessel had reached the extreme limit of stretching and could not be thinned out any more

RECURRENT STONES IN THE URINARY BLADDER

DR HARRY P CARMANY, in presenting this case, said that he had reported it before to the Academy in 1911 as one of a rather large stone removed by spinal anæsthesia At that time cystoscopy was ineffectual on account of size of stone, although sounding and X-ray discovered it He was admitted to St Timothy's Hospital October 11, 1911. He was fifty-eight years old On admission complained of frequent urination and a sense of burning in perineum Sound revealed stone, X-ray confirmed it Removal under spinal anæsthesia, was in hospital 49 days, when he was discharged cured He remained well until June, 1913, when he again began to have frequent urination and burning in perineum, July 10, 1913, he was again admitted to the hospital with a distended bladder His condition was such that little time was consumed trying to pass instrument, and suprapubic drainage was immediately decided on He was given chloroform, as his

nancy, which is implanted upon a thick lamellar structure composed chiefly of concentric layers of fibrous tissue in which can be seen what are apparently bundles of smooth muscle. The attachment of the placenta to this fibromuscular wall is not an immediate one, but is obtained through the medium of a layer of large vesicular cells which bear considerable resemblance to decidual cells. This layer varies in thickness in different portions and in some parts spreads out into thin strands which are themselves separated by fibrous bands.

Dr Whiting remarked that this case was of more or less interest on account of the length of gestation, and on account of the termination, rupture of the vessel on the outer aspect of the wall of the gestation sac without any rupture of the sac wall. The absence of symptoms of tubal pregnancy might be noted, as well as the perfect freedom of the tumor within the abdominal cavity, there being no restriction other than its attachment to the broad ligament and the cornua of the uterus.

Although Tait, in his memorable articles on the subject of tubal pregnancy, claimed that primary rupture of the sac of a tubal gestation occurred at or before the fourteenth week, numerous cases greatly exceeding this period, without rupture, have been recorded. The average length of tubal gestation, without rupture or the expulsion of the embryo through the fimbriated extremity, however, is much less than that recorded in this case. Thus Webster quotes Henning as having reported 95 cases of tubal pregnancy in which rupture occurred in 80 per cent before the sixth month. In this series of cases, 1 ruptured in the sixth month, 1 in the seventh, 6 in the eighth, 1 in the ninth, 9 in the tenth, and 1 beyond the tenth month. In Von Schrenk's 141 collected cases, in Schauta's 87 cases, and in Mackenrodt's 38 cases, rupture took place in every instance before the expiration of the fourth month (quoted by Webster).

At the German Hospital, during the last ten years, there have been 128 cases of tubal pregnancy. Operations in these cases were performed by Dr J B Deaver, to whom he was indebted for the privilege of citing them, by Dr G G Ross or himself. In 99 of these patients, rupture through the wall of the tube had taken place, in 10 the products of gestation, in whole or in part, had been expelled through the fimbriated extremity, and in 5 there had been bleeding from the fimbriated extremity at or before

the time of operation Fourteen cases were operated upon before rupture or bleeding had taken place

Among the cases that ruptured, aborted, or bled from the fimbriated extremity, the catastrophe occurred in 3 during the first month, in 57 during the second month, in 30 during the third month, in 13 during the fourth month, and in 2 during the fifth month In 9 cases the period of gestation was not stated

In a very limited search through the literature of tubal pregnancy, he was unable to find any reference to a termination similar to that recorded in this case In all of the cases noted, there was rupture of the sac wall, expulsion through the fimbriated extremity, or free bleeding from the fimbriated extremity without expulsion of the gestation products In this case there was a rupture of the wall of one of the ribbon-like vessels without any discoverable rupture of the sac This rupture was possibly caused by traumatism during the violent vomiting and retching, although the vomiting may have been due to the ruptured vessel and not to the sandwich, to which the patient attributed it If caused by the marked activity of the foetus on the day of the rupture, it is probable that some signs of internal violence would have remained or that the sac itself would have been ruptured Possibly the vessel had reached the extreme limit of stretching and could not be thinned out any more

RECURRENT STONES IN THE URINARY BLADDER

DR HARRY P CARMANY, in presenting this case, said that he had reported it before to the Academy in 1911 as one of a rather large stone removed by spinal anæsthesia At that time cystoscopy was ineffectual on account of size of stone, although sounding and X-ray discovered it He was admitted to St Timothy's Hospital October 11, 1911 He was fifty-eight years old On admission complained of frequent urination and a sense of burning in perineum Sound revealed stone, X-ray confirmed it Removal under spinal anæsthesia, was in hospital 19 days, when he was discharged cured He remained well until June, 1913, when he again began to have frequent urination and burning in perineum, July 10, 1913, he was again admitted to the hospital with a distended bladder His condition was such that little time was consumed trying to pass instrument, and suprapubic drainage was immediately decided on He was given chloroform, as his

cough was still present which had determined the use of spinal anæsthesia at the first operation. On opening his bladder, a calculus was forced out and on examination another one was found loose in bladder and yet another impacted in the posterior urethra.

DR ALFRED C WOOD said, in regard to the re-formation of stones, or stones thought to have been overlooked at the time of operation, if a patient has some obstruction to the emptying of the bladder, either prostatic or urethral, and particularly if he has infection of the urine with ammoniacal decomposition, stones may form in a comparatively short time. Also in a certain number of cases there may be stone lodged in the ureter which later coming down forms a nucleus for a larger stone. He recalled one case in which during a suprapubic lithotomy, after removing a great many stones, four ounces in all, one was found projecting from the ureteral orifice. This was removed, when another was felt and removed, and so on until five had been delivered from the lower end of the ureter. If these had not been discovered they might later have appeared in the bladder and given the impression that they had been left from the previous operation.

DR JOHN SPEESE said that about three years ago he operated upon a boy two years of age, and removed three stones from the bladder by the suprapubic method. The boy returned to the Children's Hospital several months ago with renewed symptoms of vesical calculus, and another stone was removed by Dr Wharton. The calculi removed at the first operation were phosphatic, octagonal in shape, smooth, and each was about the size of a small hickory nut. The stone removed at the second operation was about the size of an almond, mulberry in appearance and was composed of urates. After complete recovery symptoms of a stone in the kidney developed, and an X-ray corroborated the diagnosis.

Such a case demonstrates the possible recurrence of vesical calculi at an early age, although the subsequent history of a kidney stone points to this organ as the point of formation of the vesical calculi.

DR ADDINELL HEWSON, in connection with the stones not being found, said that some years ago he found in a man whose history he obtained subsequently, eighty years of age, who came from an almshouse in the interior of the State, a completely

encysted mulberry calculus about the size of an ordinary thimble, completely walled off from the bladder. It was just behind the symphysis pubis. The man had complained of no symptoms whatever of stone.

SARCOMA OF THE SMALL INTESTINE

DR JOHN SPEESE presented a paper with the above title, for which see page 727.

DR JOHN H. JOPSON remarked that in 1901, Dr C. Y. White and he reported a case of sarcoma of the large intestine in a child of four years. They collected, as Dr Speese had mentioned, 22 cases of sarcoma of the large intestine above the rectum, all that they could find in the literature at that time, and they excluded all cases in which there was not a reasonable certainty that the process was primary in the large bowel. Shortly before this Libman had collected 59 cases of sarcoma of the small intestine, and the difference in the number of cases in his series and in theirs represents fairly accurately the comparative percentage of frequency of sarcoma in these two portions of the intestine.

In the rectum sarcoma is more frequently met with than in either the large bowel or the small intestine, but its symptoms do not differ materially from carcinoma of the rectum, whereas, in the remainder of the large intestine, namely, the cæcum and colon, the symptoms are so strikingly different from carcinoma that the difference has been emphasized by all observers. This is due especially to the absence of obstruction in cases of sarcoma, an observation that is also true of sarcomata of the small bowel.

Dilatation of the affected region, either as a fusiform or sacculated dilatation, is the rule, although in some cases the bowel is converted by infiltration into a thick-walled tube. This dilatation has been explained by the early infiltration and paralysis of the muscular fibres. In only one of the 22 cases which they studied was complete obstruction present. In this case the tumor was of the spindle-cell type and situated in the descending colon, causing almost complete stenosis with impaction of the opening by a small fecal mass. In one other case of a round-cell sarcoma of the sigmoid flexure incomplete obstruction was present.

The lymph follicles in the mucosa or submucosa seemed to be the usual starting point in these cases, and from this region the tumor involved the other coats, the muscular offering the greatest, and the subserous coat, the least resistance. The serosa itself

was rarely perforated Dr Spcese mentioned the possibility of sarcoma developing in the subserous coat

Their cases were almost equally divided as to sex They ranged in age from 2 to 60 The first decade contained the greatest number, and the fourth decade the next greatest There were only three cases over forty years of age The duration in cases not operated upon varied widely, probably four to six months was the average after the tumor was detected The mortality in cases operated upon has shown a great improvement since they collected their cases At that time the mortality was 50 per cent Of the cases recovering, one died of a quick recurrence The other four were living at the time they were reported

With our present familiarity with operative technic and the early performance of operation in abdominal tumors the mortality is no doubt at the present time very much below this figure

DR JOHN H GIBBON said that he had never seen a sarcoma of the small intestine but was interested especially in the question of resection in this condition As surgeons realize the importance of the small intestine as a digestive organ their respect for the stomach decreases One may get along very well without a stomach, but it is difficult without the first portion of the small intestine One may take out only a small amount, two or three feet, of small intestine, and the patient will suffer greatly from inability to digest his food He had seen this even where he had only taken out 18 inches two or three feet away from the beginning of the jejunum The diarrhœa will keep up for months and the patient will go down to a shadow Most of his cases had been in tuberculous individuals Two years ago in a case with an enormous lipoma producing intestinal obstruction he did a resection in order to remove the growth which at first he thought to be an inoperable retroperitoneal sarcoma, in this case it was necessary to resect a large amount of small intestine in order to remove the tumor, and he found himself within three inches of the jejunum, with just enough bowel to make an anastomosis, and he had removed $9\frac{1}{2}$ feet of small intestine This man for a short time had little disturbance, but for 18 months he was very sick, had diarrhœa, could not digest his food, everything gave him pain, he passed his food undigested, lost weight, and only in the last six months has the remaining portion of his intestine taken on the function of the resected portion, so that he is now getting better

DEPOSIT OF METALLIC SILVER IN BODY TISSUES 751

DEPOSIT OF METALLIC SILVER IN BODY TISSUES

DR. ADDINELL HEWSON gave a preliminary notice of the fact that he had been able to deposit metallic silver in the glomerule of the kidney in cadavers. The process by which this was attained was by injecting into the aorta a 2 per cent solution of nitrate of silver and a 5 per cent solution of formaldehyde in distilled water. Immediately following this mixture, a 2 per cent solution of ammonia in distilled water was injected and the deposit of silver could be seen increasing in the papillary layer of the skin, giving the subject a mottled appearance.

Dr. Hewson reported that at a subsequent meeting he would show specimens of this work with the various tissues, but desired to give formal notice of the fact that he had succeeded in making a deposit of metallic silver in the tissues.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

*Stated Meeting, held at the New York Academy of Medicine,
October 22, 1913*

The President, DR FREDERIC KAMMERER, in the Chair

TUMOR OF THE CAROTID

DR FRANK S MATHEWS, presented a man, twenty-seven years old, upon whom he had operated two and a half years ago for a tumor of the carotid body. The man stated he had noticed all his life that there was a greater fulness in the left side of the neck than the right.

Dr Mathews said he made an attempt to remove the carotid tumor, but its extirpation proved impossible because of its ill-defined character, the great vascularity of the surrounding tissues, and the infiltration of important structures. The man had remained in fairly good health and had continued at his usual occupation. The growth was still small, although perhaps fifty per cent larger than at the time when the operation was attempted, two and a half years ago. At that time a section was removed for examination, it was pronounced an "alveolar sarcoma," the pathological picture closely resembling that described in other cases of this rare form of tumor.

This patient now presented all the important characteristics of this type of growth, which were largely explained by its vascularity and its origin at the bifurcation of the carotid artery, inside of the sheath. The involvement of the pneumogastric, hypoglossal and sympathetic nerves was shown by the paralysis of the left vocal cord, hemiatrophy and paralysis of the tongue, and contraction of the left pupil. The growth extended upward from the carotid bifurcation to the base of the skull and the anterior parotid

region The left side of the pharynx was pushed inward, the tonsil was near the middle line, and its pillars were œdematous There was a bruit, synchronous with the heart beat, over the tumor and upon the cheek, together with a rather definite expansile pulsation

At the time of operation the internal jugular in the lower part of the neck was empty, while the veins in the upper neck were much engorged

The speaker said that the high mortality following the operation, the fact that at times it had to be abandoned, the dangers of carotid ligation and the rather characteristic symptom-complex emphasized the importance of diagnosis while the tumor was quite small, so that the operation could be done at an early stage, if at all The exceeding difficulty of these operations was generally admitted Though the tumor in this case was still small when the patient first came under observation, its removal was abandoned when it was found that the carotid, the internal jugular, important nerves, and the pharyngeal wall, would have to be removed It would have been difficult to ligate the internal carotid above the tumor, which seemed to extend up to the base of the skull

HYGROMA OF THE NECK

DR MAIHUEWS presented a child, three and a half years old, that came under his observation with a tumor on the right side of the neck The growth was soft and fluctuant, like an abscess On operation, it was found that it extended down underneath the clavicle, and was made up of a number of compartments, like those in the cases described in the paper of Dr Charles N Dowd, which was published in the ANNALS OF SURGERY, issue of July, 1913

HYGROMA OF AXILLA AND NECK

DR WILLIAM A DOWNS presented a girl, nineteen years old, who was admitted to St Luke's Hospital on September 8, 1913, with the history that ten months ago she first noticed a swelling in the right axilla, which gradually increased in size It was not painful nor tender, but in the last few weeks it became so large that it interfered with the free use of the arm, and in this way gave rise to pain

Examination showed that the entire right axilla was occupied by a cystic tumor extending upward behind the clavicle and displacing the left breast downward and forward. The overlying skin was not adherent and the growth was movable over the deeper tissues.

The growth was exposed through a transverse incision, to which a vertical incision was added, extending down from the centre. It was necessary to divide both the pectoral muscles in order to enucleate the growth, which was removed intact with the exception of one small loculus, which ruptured. The divided muscles were then sutured, and the wound was closed. The patient was discharged on September 20. The growth proved to be a hygroma.

SPLENECTOMY FOR SPONTANEOUS RUPTURE OF THE SPLEEN IN TYPHOID FEVER

DR WILLIAM A DOWNES presented a man, thirty-six years old, a physician, who was admitted to the New York Hospital, in the service of Dr Lewis A Conner, on February 20, 1913, with the diagnosis of probable typhoid fever. Up to the onset of his symptoms, seven days before, he had never been seriously ill in his life. He had never had malarial fever nor any other disease likely to lead to enlargement of the spleen.

Upon examination, the abdomen was full and soft. No rose spots. Liver dulness extended in mamillary line from the sixth rib to the free border. The edge of the liver could not be made out. Both kidneys were indistinctly felt, not tender. The area of splenic dulness was considerably increased, extending from the eighth to the eleventh rib, and anteriorly 3 cm beyond the costal margin. The edge of the spleen was distinctly felt, even with quiet respiration, and on deep inspiration it extended fully 4 cm below the costal margin. It was unusually broad, its edge was blunt and rounded, and its consistence noticeably firm and tense. Palpation of the spleen caused distinct tenderness.

The patient's temperature, on admission, was 100.4° , respirations, 22, pulse, 88. On February 21 he passed a restless night, with much headache and general discomfort. Early that evening he complained of a sudden, sharp, stabbing pain in the left hypochondrium, soon followed by a severe, aching pain in the

left shoulder, radiating somewhat down the left arm. Soon after the onset of the pain he vomited a small quantity of clear fluid, and broke into a profuse perspiration. The pain was so severe as to require an injection of morphine. The respirations were rapid and shallow, there was marked tenderness to pressure just below the costal margin, where the spleen could be distinctly felt, and slight rigidity of the upper part of the left rectus muscle. At times, the pain was felt somewhat in the right hypochondrium.

On February 22 the severe pain in the left side and left shoulder continued throughout the night, in spite of a second injection of morphine. When seen in the morning, the patient looked much more seriously ill. His eyes were sunken, his features drawn and anxious, his respirations shallow and hurried. There was distinct tenderness in the left hypochondrium, and slight muscular rigidity, so that the spleen could not be distinctly felt. The area of splenic dulness, however, seemed larger than on admission. On February 23 the patient passed another restless, uncomfortable night, complaining chiefly of headache and nausea. At times he was slightly delirious. During the day his general condition and appearance improved much, and he was able to take and retain a fair amount of liquid food. The bowels were moved satisfactorily by enema. The pain in the left side had ceased to be troublesome, but there was still slight tenderness in the left upper quadrant. The physical signs in the chest were unchanged, and it was impossible to determine the nature of the violent attack he had had two days before. The occurrence of a pulmonary infarct was suspected, but neither the symptoms nor the physical signs were sufficiently characteristic to justify the diagnosis. The extremities showed no indications of a thrombophlebitis.

On February 24 the patient's general condition was still further improved. He passed a comfortable day and night and seemed to be settling down to a fairly normal typhoid course. Although the Widal test was still negative, blood cultures taken on February 21 showed a Gram-negative bacillus which resembled bacillus typhosus, and which two days later was identified positively as such.

On the morning of February 25, the patient awoke, refreshed after a comfortable night. At 8.30 A.M. he had an attack of coughing, and immediately afterward complained of the same

very severe pain in the left hypochondrium and left shoulder. The pain persisted during the morning, and was accompanied by profuse sweating and by the same startling change in the patient's appearance and general condition. His pulse was rapid, small and soft, his respirations hurried, his skin covered with cold sweat and he complained of weakness and nausea. It was evident that something serious had happened, and that his condition was growing progressively and rapidly worse. Examination of the chest showed no change from that of the preceding days. There was dulness on percussion over the greater part of the left side of the abdomen and in the left flank, and some rigidity and tenderness in the left upper quadrant. The rest of the abdomen was soft and flat, and while having a somewhat boggy feel, was not tender. Dr Downes and Dr S W Lambert were called in consultation, and all agreed that the symptoms indicated a rupture of the spleen. The diagnosis was arrived at by considering the location of the pain, the tenderness and the muscular rigidity, by the absence of signs pointing toward other likely complications, such as intestinal perforation and pulmonary infarct, and, finally, by the fact that the spleen had been recognized as being unusually large and tense for the early days of typhoid fever. With the hope of obtaining some confirmatory evidence of severe hemorrhage, a blood examination was made about three and a half hours after the onset of the pain, and while the symptoms pointed strongly to an alarming loss of blood, the examination gave the following results: red cells 5,280,000, hæmaglobin (Sahl) 85 per cent, leucocytes 35,000.

In spite of these apparently inconsistent blood findings, an immediate exploratory operation was decided upon, and at 1 45 P M, about five hours after the onset of the symptoms, the patient was taken to the operating room. The temperature, which at 8 A M had been 102.8°, had fallen to 100°, the respirations were 32, the pulse rate 118. Dr Downes, under local anæsthesia, opened the abdomen by a vertical incision through the middle of the left rectus muscle. Upon incising the peritoneum, the abdomen was found to contain a large amount of blood. The patient was thereupon given nitrous oxide gas and ether by Dr. Thomas L Bennett, and the incision was rapidly enlarged to the extent of eight inches. A tremendous quantity of fresh and

clotted blood, estimated at from a quart and a half to two quarts, escaped from the abdomen. The left hand was immediately passed to the pedicle of the spleen, which was grasped between the index and middle fingers, and with the right hand the spleen was delivered through the wound. At this point the pedicle was caught with a long, straight rubber-covered clamp, placed close to the spleen. The vessels were then ligated about two inches proximal to the clamp with No. 2 chromicized catgut. The larger blood clots were rapidly removed and the abdomen was closed by layer sutures, without drainage. Time of operation, twenty minutes.

When the hand was first placed behind the spleen lying in its bed, a rent in the capsule, fully three inches in length and running along the posterior border, was encountered. During the manipulation this rent was so enlarged that by the time the organ was delivered from the wound the capsule had been stripped from almost half its surface.

In spite of his critical condition on the operating table, which necessitated an intravenous infusion of salt solution, the patient improved steadily during the succeeding twelve hours. His loss of fluid was replaced by saline solution given by hypodermoclysis and by the Murphy "drip." At 10 P. M. that night the haemoglobin percentage had fallen to 62, and his leucocytes numbered 68,000. On the following morning (February 26) the pulse had fallen to below 100, and his general condition was very satisfactory. The patient's convalescence was delayed by signs of a pulmonary infarction and a thrombophlebitis of the right arm and calf, but these symptoms gradually subsided, and he was able to leave the hospital on March 31, 1913. A month later he had regained his lost weight and seemed in almost his usual health. At the present time, his health was excellent.

SPLENECTOMY FOR TRAUMATIC RUPTURE OF SPLEEN

DR. JAMES M. HIRZORI presented a boy of fourteen who was admitted to the New York Hospital with the history of having fallen from a truck, striking the edge of the curb on his left side. He felt weak and sick after the fall and complained of severe pain in the left lumbar region. The pain was aggravated on inspiration. He also suffered from thirst.

On admission, the boy was in a state of mild shock. His

temperature was 98.6°, pulse 120, regular and of small volume, respirations 48 per minute and gasping in character. The abdomen, which was slightly scaphoid, showed a small contusion over the left tenth rib in the posterior axillary line. The abdomen did not move on respiration, and there was tenderness, especially along the left gutter, with rigidity, but no spasm. In the left loin there was tenderness on deep pressure, with dullness. A blood count gave 18,000 white cells, with 85 per cent of hæmaglobin.

The case was regarded as one of rupture of the spleen, and the patient was operated on one hour and fifteen minutes after the injury. A six-inch incision was made through the outer border of the left rectus, revealing a bellyful of blood and a lacerated spleen, with its pedicle torn through at the hilum. A clamp was applied and the spleen removed. The tail of the pancreas was elevated, and a spouting artery running parallel to it was clamped. A clamp was also applied to a mass of infiltrated tissue, the lienorenal ligament, just above the artery. There was some oozing in the phrenosplenic ligament which was controlled by gauze. A small accessory spleen was made out, about 1.5 x 1 cm. in size, just mesial to the clamp on the splenic artery. The free blood in the peritoneal cavity was evacuated by suction. The boy was given an intravenous saline infusion, and the wound was closed by tier suture with a small cigarette drain to the site of the oozing in the phrenosplenic ligament.

The patient made an uninterrupted recovery, the drain was removed on the fourth day, and the wound healed *per primam*.

An examination of the patient's blood, made on the day of the operation, showed 4,288,000 red cells, 18,450 leucocytes, with 85 per cent polynuclears and 15 per cent mononuclears, hæmaglobin 55 per cent. Two days later the leucocytes had risen to 34,500, with 91 per cent of polynuclears, the hæmaglobin had fallen to 47 per cent and the red cells to 3,756,000. There was a gradual decrease in the leucocytosis, with a slow rise in the hæmaglobin, and on September 29, eighteen days after the operation, the red blood cells numbered 3,380,000, the white cells, 17,200, with 75 per cent of polynuclears and 61 per cent of hæmaglobin. The latest blood examination, made on October 22, 1913, showed 4,432,000 red cells, 14,400 white cells, with a differential picture of 58 per cent polymorphonuclears, 33 per cent small mononuclears, 3 per cent large mononuclears, 3 per

cent eosinophiles, 2 per cent cosmophiles, and 1 per cent transitionals. The hæmaglobin was 76 per cent.

DR HITZROT reported a second case of traumatic rupture of the spleen in a boy, seven years old, who was admitted to the House of Relief, in the service of Dr Alexander B Johnson, on August 26, 1913. The history obtained was that he was knocked down by a truck, and it was thought that one of the wheels passed over his abdomen. When he was brought to the hospital, at 12 50 P M, he was in a condition of marked shock. His temperature was 97°, pulse, 160, respirations, 32. There were no external signs of violence. The abdomen was somewhat distended and there was marked general tenderness and rigidity with dullness in both flanks—slightly movable. The blood-pressure was 70 mm.

At 4 P M, four hours after the injury, the abdomen was opened, and a ruptured spleen completely torn loose from the pedicle and lying loose in the splenic fossa was found and removed. During the operation, an infusion of warm saline was given. Salt solution was also introduced by the Murphy "drip," and the patient was surrounded with hot water bottles. About an hour after the operation, the patient's pulse, which had improved considerably under stimulation, again became weak, and he went into a state of profound shock, which ended fatally at 8 20 P M.

Both these cases are reported to emphasize the greater seriousness of that type of splenic rupture in which the laceration involves the hilum, a fact pointed out by Berger (*Archiv f. klin. Chir.*, Bd 68, 1902), who states that this injury is rare and also that the recovery from it is less frequent than in the other type.

DR ELLSWORTH ELIOT said that he had never seen a case of spontaneous rupture of the spleen. He had, however, seen a considerable number of cases of traumatic rupture of the spleen and in speaking of the etiology of this form of injury, there was one predisposing factor which he had met with in two of his cases, namely, a history of malaria, with the formation of adhesions which had bound the spleen to the ribs and rendered it more susceptible to the effects of trauma, through limitations of its movement.

In one of his cases, Dr Eliot said, the patient was a young girl, who, while riding on a pony, slipped or slid to the grass, giving no indication of direct trauma. Her symptoms led to the diagnosis of rupture of the spleen, and upon laparotomy, a tear

of the spleen on its diaphragmatic surface was discovered with considerable blood in the left flank. As hemorrhage had ceased, a tampon was inserted, the spleen remaining *in situ*. The patient made a good recovery. Here the rupture was evidently the result of indirect violence.

Dr Eliot said that in the recognition of this condition, particularly before hemorrhage has been excessive, he had found dulness in the left flank elicited by auscultatory percussion of great assistance. As to the end results of splenectomy, he had investigated, in 1906, the literature to ascertain if there was any actual lowering of the resistance produced by the loss of the spleen, and had found only a single instance where the short, rapid, and uneven course of a subsequent lobar pneumonia was ascribed to such particular factor. In one of his own cases the patient had a very interesting history, and ultimately died of diffuse suppuration of the liver, in connection with a cholelithiasis of long standing.

As bearing upon the blood findings after splenectomy, the speaker said that in one instance, in the course of the operation, several small accessory spleens were found in the gastrosplenic omentum. Much depended on the presence or absence of these small segments of splenic tissue, which might easily escape detection. The rapid return of some of these patients to an apparently normal condition, as well as the absence of any manifestation of impaired resistance, which are not at all uncommon, might be ascribed to the presence of these bodies.

Dr FREDERIC KAMMERER said that about eleven years ago he presented a case at a meeting of this Society very similar to that shown by Dr Downes. In his case, the rupture of the spleen occurred during the third week of typhoid fever. It was evident that the patient was suffering from a hemorrhage, and upon opening the abdomen through a median incision, he found the peritoneal cavity filled with blood. Upon lengthening the incision and removing the blood clots, a much enlarged spleen was found, with a rent about four inches long in its capsule. In the course of the most careful manipulations, this rent suddenly increased to about eight inches, the pulp protruded from the rent and as the hemorrhage was becoming alarming, the spleen was removed. The patient died about twelve hours later. The specimen after operation showed a simple tear in the capsule, which did not

extend into the pulp of the spleen. The latter was absolutely intact, and it was evident that hemorrhage had occurred from the separation of the capsule from the pulp. This, at the time of the presentation, was considered very unusual, some authors even denying the possibility of such an occurrence.

DR DOWNES said that Dr Conner, after a very exhaustive search, had found a record of only twelve similar cases in the literature. In nine of these, the condition was discovered at autopsy, in the three remaining cases, including the one reported by Dr Kammerer, the rupture of the spleen was found in the course of operation done for supposed intestinal perforation. None of these cases recovered.

DR HITZRO1 said that in the case he had shown there was an accessory spleen about one and a half cm long and one cm wide. This was found near the pedicle.

GANGRENE OF THE CÆCUM SECONDARY TO CARCINOMA OF THE COLON

DR JOHN A. HARTWELL presented a salesman, thirty-four years old, who was admitted to the Presbyterian Hospital on May 1, 1913, with the following history:

He was operated on for chronic appendicitis in 1909. Normal convalescence. Since this time up to the beginning of the present trouble he has considered himself in good health, though on careful questioning he states that he has noted some increasing constipation over a recent period. His present illness dates back for one week, and began with acute abdominal pain, distributed pretty generally over the abdomen, with marked constipation, though the bowels have moved after energetic catharsis. Vomiting occurred after two or three days, and the pains got increasingly more severe and gradually became localized to the lower part of the abdomen, more particularly in the right lower quadrant. On admission he presented a typical picture of intestinal obstruction, and the diagnosis of this condition, due to adhesions from a previous operation, was made. Operation was immediately performed, an incision being made in the cecal region. On opening the peritoneum there was an evacuation of about six quarts of intestinal contents with considerable solid fecal matter. This was mostly confined to the pelvis, but there was some evidence of it extending throughout the peritoneum. The entire interior

wall of the cæcum had sloughed away, making an opening several inches in diameter in which the ileocaecal orifice presented. An adherent band running from toward the midline outward to the ileum seemed to have completely shut off circulation, causing the cæcal gangrene. The abdomen was thoroughly washed out with large quantities of normal salt solution, by means of a suction apparatus, and drains were inserted. He was returned to the ward in fair condition, and immediately began to have copious evacuations through the open cæcum, which had been loosely attached to the skin wound. During the 36 hours following operation he received continuous hypodermoclysis of normal salt solution of which he absorbed 7 litres. This was given following the teaching of Hartwell and Hoguet whose experimental work showed that a serious factor in intestinal obstruction was the dessication of the tissues. His recovery was long and tedious, and in late July an operation was performed for the closure of the fecal fistula, it being planned to make an anastomosis between the ileum and the ascending colon, with the removal of the intervening portion of the large bowel. On opening the abdomen, however, a firm hard tumor was found in the splenic flexure of the colon, causing a complete obstruction. Grossly, this presented all the characteristics of a carcinoma. A number of lymph-nodes in the vicinity were found involved, one of which was removed for examination, and proved to be non-malignant. Lateral anastomosis was made between the ileum and the descending colon below the obstruction, the ileum having been sutured near the cæcum and the two ends closed by inversion. His condition since the operation has steadily improved. He has normal movements per rectum and there is practically no discharge from the cæcal fistula which drains the large bowel as far as the stricture at the sigmoid flexure. The question to be considered is as to the advisability of removing the growth above the anastomosis, and if this is done, what shall be done with the portion of the large bowel between this point and the cæcum?

The interesting points in the case are the fact that a patient could survive the conditions found at the original operation, and the fact that the occlusion of the bowel had gone on to such an extent without symptoms, and the marked benefit that he apparently received from the absorption of such an enormous amount of salt solution in the first hours after his operation.

DR GEORGE WOOLSEY, who had seen Dr. Hartwell's patient during the operation, said it then looked like a very unpromising case. As to the future outlook of the case, the speaker said that in view of the fact that in malignant growths of the large intestine it was not uncommon to find enlarged lymph-nodes that did not show carcinoma, the pathological findings in this case could not be regarded as particularly helpful in determining the character of the new growth. The patient was certainly sufficiently advanced in age to allow of the diagnosis of a malignant tumor.

Dr Woolsey said this case recalled a somewhat similar case that came under his observation some years ago. The patient was suffering from intestinal obstruction, and an opening was made in the cæcum which relieved an enormous dilatation of the cæcum and ascending colon. Subsequently, the obstruction recurred and was relieved by severing a lot of adhesions. Still later, a tumor was found in the splenic flexure which on removal proved to be malignant. That patient was only twenty-two years old.

DR KAMMERER said that acute obstruction, without any previous symptoms, was not so very rare as cancer of the large intestine. Compensation, by hypertrophy of the intestine proximal to the seat of trouble, often delayed the development of any marked clinical symptoms until the lumen of the gut had been narrowed down to a very small passage. Then the arrest of some intestinal contents at this point might cause complete obstruction, temporary perhaps, but, at all events, the first serious symptom manifested in the case.

DR HARTWELL, in closing, said this man had absolutely no symptoms of obstruction until the sudden onset of complete obstruction. Several weeks ago he saw a somewhat similar occurrence in a woman, who, with the exception of some cramp-like pains dating back for a number of years, had been comparatively free from symptoms until the day prior to her admission to the hospital, when she was seized with acute vomiting. An exploratory operation revealed a complete obstruction of the bowel by constriction at the splenic flexure. That patient died.

BONE TRANSPLANT SUPPLYING THE UPPER THIRD OF THE HUMERUS

DR GEORGE D. SILWART presented a school-boy of eleven years who was admitted to St. Vincent's Hospital on June 1, 1912,

with the history that on that day he had been knocked down by horse-car, one of the wheels passing over his right arm at shoulder

Examination showed a compound, comminuted fracture of the upper end of the right humerus. The axilla was opened so that the finger could be introduced through the wound, and the axillary and brachial arteries were exposed, but the patient had good radial pulse, could move his fingers, and sensation was unimpaired. The wound, which was much soiled, was irrigated with iodine solution, and packed with gauze to check the bleeding. On the following day he was taken to the operating room, where loose fragments of bone were removed and drains inserted. The radial pulse still continued good. Following this, there was a good deal of sloughing of soft tissues, and on July 6, several fragments of necrosed bone were removed. After a time, the sloughing ceased, and on October 1 the patient was discharged, the wound having completely healed. At this time there was a false point of motion above the middle arm and it was evident that there was an absence of bone in this region. Indeed, the tissues here were so contracted that little remained but the artery, nerves and some scarred integument.

In November, 1912, he returned to the hospital, and on the 13th of that month a transplant was taken from his tibia. This section of bone, which was about three inches in length and perhaps half the diameter of his fibula, was then inserted between the ends of the two fragments of the injured humerus. In doing this, it was difficult to find sufficient soft material to completely cover the transplant. The ends of the fragments were very sharp, and it was necessary to cut them off transversely so as to get a point of application for the ends of the transplant. As the arm had shortened considerably by contraction of the soft tissues since the time of the injury, the transplant had to be introduced under strong longitudinal traction, and difficulty was experienced in lengthening the arm because of this contraction. During the necessary dissection, the musculospiral nerve, which was much distorted, was accidentally divided and had to be sutured.

The wound healed by primary union excepting at one point, where there was a slight separation of the cut surfaces, which did not, however, extend to the depth of the transplant. Within a

Fig. 1



1 mb before transition

Fig. 2



Limb after transplant

week, the arm seemed to be rigid throughout, and as far as could be made out, there was never any atrophy of the transplanted bone. The paralysis following the operation involved all of the musculospiral distribution. Under massage, this began to improve after a few weeks, and this improvement had steadily continued.

Dr. Stewart said that periosteum was left on the transplant covering two of its four sides. No particular pains were taken to preserve it, and in many parts its edges were raised. Whether it had any influence upon the nutrition of the bone, he doubted. In another case where he utilized a rib to form a bridge in a sunken nose, he relieved the rib entirely of its periosteum, and it seemed to serve equally well. If McEwen's findings were correct, periosteum contained no osteogenetic layer, and served simply as a limiting membrane.

In connection with this case, Dr. Stewart showed a number of X-ray pictures, illustrating the conditions before and after the operation (see Figs. 1 and 2).

This case is presented not only for its interest in connection with the transplantation of bone but also as an illustration of the value of conservative surgery in compound fractures. When it first came under the care of Dr. W. C. Lusk, who was on duty, the conditions were such that amputation seemed almost inevitable, the limb being attached to the body by barely sufficient tissue to carry the vessels and nerves. The result is a very serviceable, almost normal limb.

BONE TRANSPLANT IN A CASE OF RECURRENT FRACTURE OF THE PATELLA

Dr. JOHN ROGERS presented a young woman to illustrate a case of bone grafting in recurrent fracture of the patella. The original fracture in this case occurred on November 1, 1912, and was treated by suture. The following February the patient slipped and re-fractured the patella, and at this time, in addition to the usual treatment of suture, Dr. Rogers chipped a small bone graft from the front of the tibia, and after lifting the patella periosteum, he inserted the bony graft underneath and sutured it there. The result was excellent. The graft has not become absorbed. A radiograph taken in October, or one month after

FIG 2



Limb after transplant

where an ingenious apparatus was devised to replace the lower jaw bone

This consisted of a bridge which was fastened to the molar teeth on the upper jaw, at each end of the bridge there was a ball-and-socket joint. And from the lower surface of each ball there extended downward a pivot, which fitted into a socket in the ascending ramus of an artificial lower jaw bone, made of gold, on which were teeth. This gave a shapely contour to the lower portion of the face, an open and shut action of the mouth, with, also, a slight grinding or lateral motion.

THE FORMATION OF A NEW THUMB BY KLAPP'S METHOD

DR H. H. M. LYLE showed X-ray plates and photographs of a case where a new thumb had been formed from the metacarpus. This patient's left hand was run over by a trolley car. The thumb, index and middle fingers were evulsed at the metacarpophalangeal joints, the ring-finger at the base of the first phalanx. There was a fracture of the metacarpus of the thumb, the dorsal skin was destroyed up to the level of the wrist, the tendons of the above fingers were torn off.

Operation at St. Luke's Hospital. The stump of the hand was trimmed, the torn tendons brought down and sutured over the ends of the bones, the fracture of the first metacarpus corrected, the whole enclosed in a saturated dressing of Balsam of Peru.

The wound remaining clean, the hand was inserted under an abdominal pocket flap. The flap took nicely and provided a good covering for the dorsal aspect of the hand and wrist. A curved dorsal incision dividing the soft parts between the first and second metacarpals was made, the first metacarpus mobilized by separating the attachment of the dorsal interossei. In this way it was possible to approximate the metacarpus of the thumb and little finger. Care was taken to avoid injuring the thenar muscles. The skin of the dorsum was carried around the metacarpus of the index finger and united to the palmar skin, the carpus of the thumb being treated in a similar way.

The most important finger in the hand is the thumb and its loss is a serious misfortune. Klapp's method, by producing a short but useful thumb, provides an anchorage of the dressing condition, and marks a distinct advance in the traumatic surgery of the hand.

insertion of the graft, shows it still in place and unchanged in size Its under surface has blended with the anterior surface of the patella, and the former line of fracture is filled with bone This method of treatment was employed by Dr Rogers to repair a non-union of the patella in another case, with excellent results

THE FUNCTION OF THE PERIOSTEUM IN BONE TRANS-
PLANTS BASED ON FOUR HUMAN TRANSPLANTA-
TIONS WITHOUT PERIOSTEUM AND TWENTY-
EIGHT ANIMAL EXPERIMENTS ILLUSTRATED
WITH LANTERN SLIDES

DR CLARENCE A McWILLIAMS read a paper with the above title, for which see page 465

DR JAMES M HITZROT said Dr McWilliams' paper was particularly interesting to him inasmuch as his interest was directed toward the function of the component parts of the bone in the process of repair after fractures In this repair process new bone appears from the periosteum and from the endosteum on both sides of the fractured cortex, most marked on the concave side of the fracture The cortical bone does not participate in this process until after the new bone has undergone a fairly marked degree of consolidation and there is no evidence of bone cell proliferation from the cells of the cortex In fact, the space between the fractured ends seems to become filled by cells arising from the endosteum and to a lesser extent from the periosteum, while the cortex is undergoing absorptions Cotton and Loder (*Surg, Gyn and Obstetrics*, June, 1913) consider the endosteum as the important factor in the formation of bone in the transplant My experience with cortical bone without periosteum has been similar to that of Dr McWilliams, that is, failure in four cases with absorption of the graft

In one of my grafts a fracture due to a fall occurred but the outcome was not as satisfactory as that case shown by Dr McWilliams, inasmuch as the graft became absorbed and union did not occur, although the X-ray picture had shown new bone along the surface of the graft before this accident

DR FISK said that at a recent meeting of the alumni of the Massachusetts General Hospital in Boston, Dr David F Jones had shown a case where he had resected the entire lower jaw Afterward this patient was referred to the Harvard Dental School,

where an ingenious apparatus was devised to replace the lower jaw bone

This consisted of a bridge which was fastened to the molar teeth on the upper jaw, at each end of the bridge there was a ball-and-socket joint. And from the lower surface of each ball there extended downward a pivot, which fitted into a socket in the ascending ramus of an artificial lower jaw bone, made of gold, on which were teeth. This gave a shapely contour to the lower portion of the face, an open and shut action of the mouth, with, also, a slight grinding or lateral motion.

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*Stated Meeting, held at the New York Academy of Medicine,
January 14, 1914*

The President, DR. FREDERIC KAMMERER, in the Chair

SUBCLAVICULAR DISLOCATION OF THE HUMERUS

DR. ROBERT H. M. DAWBARN presented an elderly man, who, seven months before entrance to the City Hospital, had fallen, causing a typical subclavicular dislocation of his left humerus. Repeated attempts at reduction under anæsthesia had been made before his admission. The elbow stood away from the side at an angle of about thirty degrees, and all motion of the arm was very painful.

Under major anæsthesia, one month ago, another attempt at reduction was made. This failing, the head of the humerus was excised through a vertical incision close to the anterior edge of the deltoid. It was placed thus far forward for two reasons: to save the more readily the long tendon of the biceps, and to destroy as little as possible of the value of the circumflex nerve, which inevitably had to be divided.

No attempt was made to do what seemed simple, but was really quite the reverse, namely, to free the bone from its false position, clear out all tissue from the glenoid cavity and replace the humerus. This, Dr. Dawbarn said, he would never personally attempt, at least in a case of long standing, such as this. Twice he had had the opportunity to assist excellent surgeons and dissectors at such an attempt, the first time under the late Dr. Charles McBurney, who, notwithstanding his deftness with the knife, cut the musculospiral nerve by accident. The second time was with Dr. John A. Wyeth, and after more than two hours' work it was accomplished, but the patient died from shock.

In the present case, the speaker said, he chiselled through just below the head, which was then removed in several large bites by the rongeur forceps. The work took but about twenty minutes altogether. As was now evident, after the healing, which was *per primam*, the man had a comfortable, freely movable false joint, with so little shortening of the limb as hardly to be notice-

able He was receiving daily treatment with electricity and massage, and strychnine by needle, chiefly into the deltoid muscle

BONY ANKYLOSIS OF THE ELBOW FRACTURE OF THE LOWER EXTREMITY OF THE RADIUS

DR DAWBARN presented a woman of forty, who six months before her admission to the hospital had fallen, badly breaking her right elbow and producing a fracture of the lower extremity of the radius on the same side She had sustained a similar injury of the left wrist some years earlier Both fractures were typical of improper treatment, the wrists being badly deformed, and her right elbow was entirely ankylosed She permitted operation, one month ago, upon the right limb, because, as she said, she had to work, but no persuasion could induce her to allow her left wrist to be corrected at the same time

Both operations were a success The elbow incision was a six-inch vertical Langenbeck one, the olecranon being its midpoint The triceps insertion was split and removed by "egg-shell" work with chisel and mallet, leaving its continuation into the deep fascia of the forearm intact The entire trochlear surface of the humerus had to be chiselled away, and then one of the half insertions of the triceps was freed below and so fastened as to prevent bony ankylosis Passive and active motion were both restrained from until three weeks had gone by—the usual period of exudate of callus this to lessen the exudate of provisional callus and hence new bone in the joint, in excess

At the wrist, the operation performed was that which was described in Binnie's Operative Surgery, and elsewhere, and credited to Dr. Dawbarn In the latter's opinion, it was frequently needed He had done it now over twenty times with success, and had read a paper upon it and showed patients a good many years ago at a meeting of the Fifth District Medical Society of New York State in Newburgh

The technic of the operation for the correction of the wrist deformity was as follows A vertical incision was made at the seat of the radial fracture The soft tissues were dissected off the bone, back and front, gauze being packed in as a protection during the next step, namely chiselling By this means, transversely, the bone was divided entirely, and then, by leverage, the lower frag-

ment of an inch or so was pried distally until its styloid process was, as was normally the case, about two-thirds of an inch nearer the digits than that of the ulna. Next, the matted and often useless tendons, from old tenosynovitis—those normally grooving the back of the radius here—were dissected free from other tissues to play hereafter in loose connective tissue beneath the skin. As much of each sheath as was practicable was removed. To the surgeon, the sheath was simply a nuisance, inviting adhesions again if left.

Next, at about the middle of the shaft of the ulna, a piece of this bone of about one-half inch in length was removed by use of the Gigli saw twice. This had a two-fold purpose. (a) it enabled the gap thus created to close by subsidence of the subluxated lower end of this bone, a deformity always very noticeable. Such subsidence took place spontaneously, thus encouraged, in the course of a few days. (b) The piece of the ulnar shaft thus removed was now comminuted by chisel into a number of small bits, which were tucked into the chisel-gap in the radius, thereby filling it by a bone-plastic job, preventing the chisel-gap closing together, with return of the deformity. Next, the skin was closed as usual.

In the present case the result was seen to be perfect, and, in striking contrast with the deformity of the left wrist, still uncorrected.

DR L. W. HOTCHKISS asked if it was necessary, for the correction of this type of deformity, to divide the ulna. Did not this step and the introduction of the fragments of bone into the gap of the radius needlessly complicate the operation? Personally, he had corrected many of these deformities by simply chiselling through the radius, and he did not think that a more extensive operation was usually indicated.

DR DAWBARN replied it was because of the unsatisfactory results of the old method—for simply chiselling the radius was old indeed—that he came to try the present plan. He objected to its being considered as adding a complication and taking time needlessly. Certainly it was worth while to overcome the ulnar deformity almost or quite as much so as the radial, and this could only be done by removing a piece of it, and once removed, it did not add over a minute or so to the work to comminute the ulnar

piece and make use of it in the radial gap, thus assuring maintenance of the styloid process at the level desired

DR JOHN F ERDMANN asked why Dr Dawbarn comminuted the ulnar fragment Why not place it in the radial gap just as it came from the ulna?

DR DAWBARN said that in the first place, its shape would preclude its fitting the gap in the radius, if this were tried Again, the more finely a bone was subdivided, the greater became the prospects for success in re-planting it, for its blood-vessels no longer carrying nourishment to its interior, it depended for life upon the vitalized plasma bathing it, and the more the comminution, the shorter the distance that nutriment had to be carried to the interior of the bone by capillarity—the only remaining possible way Sir William MacCormack taught us that in many cases trephine discs, if replaced and possessing a fair amount of diploe, would live, but experience proved that if the trephine disc be first well chiselled or bitten into small pieces, and then replaced upon the dura mater, its chances of surviving were greatly increased

MODIFICATION OF SYME'S AMPUTATION

DR DAWBARN presented an Italian lad of nine years who three months ago was run over by a truck, partly crushing his left foot, in consequence of which the entire foot died, including the heel This made a typical Syme's amputation impossible, and indeed, the present case differed from the regular Syme's, although performed at the usual level, in three ways, and Dr Dawbarn said he considered the case to represent a real advance in technic and in end-bearing comfort Point number one was that the entire flap had to be made from the comparatively thin skin upon the anterior surface Point number two was the fact that the main nerves, all capable of pain, were carefully shortened, so as no longer to be walked upon and nipped between the stump end and the artificial limb, a thing often occurring otherwise The posterior tibial nerve and its plantar continuation were dissected from the accompanying vessels and divided at a point some two to three inches above the stump-end The same was done with the external saphenous nerve, and (in this case) with the internal saphenous nerve Point number three had to do with the fact that a typical

Syme's amputation was a curious mixture of a good and bad principle, if we accepted, as he thought all surgeons now did, Bier's postulate that no matter how much muscle, fat and fascia covered and padded a stump-end, it could never be a thoroughly first-class "end-bearing stump" unless its bony end was covered by (a) either normal articular cartilage, or (b) periosteum. As a typical instance of the former we had a Stephen Smith amputation at the knee, and as an equally good example of the latter we had a Gritti amputation, osteoplastic, at or rather a little above that level, the patient walking upon the periosteum covering the anterior surface of his patella.

Now, as to the Syme's technic, the central two-fourths or thereabouts would be the cartilage of the lower end of the tibia, and consequently, method *a* of Bier. But on either side was a sawn malleolar surface, making the remaining two-fourths a flat violation of Bier's *b* method.

In the present case, and in a considerable number of previous cases Dr Dawbarn cited, Bier's method *b* was adhered to in principle by a simple means, namely, gnawing out by rongeur forceps the cancellous interior of each malleolus, starting from the median line of the leg and working out or in, according to the malleolus under treatment, until in a very few minutes nothing but an egg-shell-like lining of the periosteum remained. The periosteum, under the application of the usual dressings, collapsed into a firm support upon either side at the same level with the central or cartilaginous two-fourths.

Although the healing was but recent in this case, about a month since the operation, the stump face was free from all tenderness, it was firm, and jarring from below, as was demonstrated, did not cause the patient any discomfort.

In conclusion, Dr Dawbarn expressed surprise at the ignoring of the great importance of shortening all pain-bearing nerves in major amputations, so noticeable in the reports of all surgeons. Probably no improvement in amputation technic could be more important than this. For example, if he had occasion to amputate through the leg, he shortened all the five pain-bearing nerves, and this great benefit added but a few minutes to the length of the operation.

RESECTION OF THE HIP FOR TUBERCULOSIS

DR WALTON MARTIN presented a boy, twenty-one years old, who was admitted to the Roosevelt Hospital on February 5, 1909, complaining of pain and disability in the right hip. He stated that two years before that time he had first noticed pain in the right hip, and had commenced to limp. The pain gradually increased in severity so that it kept him awake at night. About a year later he was obliged to resort to crutches, and a plaster case was applied to the body and thigh, which he had worn constantly since. Otherwise he had always been well.

Physical examination at the time of the boy's admission showed marked limitation of motion, due to muscular spasm, with tenderness over the hip-joint and atrophy of the neighboring muscles. The circumference of the right thigh, four inches above the patella, was twelve inches, that of the left thigh at the same point was fourteen and a quarter inches.

On February 8, 1909, under ether anæsthesia, the hip-joint was resected. The angular incision advocated by Kocher, passing upward and backward in the direction of the fibres of the gluteus maximus and downward along the trochanter major, was made through the skin, and the fibres of the gluteus maximus and its broad fascia of insertion were divided and retracted downward. The inferior border of the gluteus medius was exposed, and the tendon of the pyriformis identified. The tendons of these muscles were separated from their insertion into the trochanter, and retracted upward. The obturator internus and the gemelli and obturator externus were divided close to their insertion. The joint was opened, the ligamentum teres divided and the head disarticulated. A Gigli saw was passed about the neck, and the head and neck removed. The thickened synovia was dissected out, and the acetabulum carefully curetted. Iodoform powder was dusted over the surface of the acetabulum and the adjacent denuded areas, the divided muscles were approximated with catgut and a gauze drain inserted to the bottom of the acetabulum. The skin was closed by silkworm gut sutures and a plaster-of-Paris spica bandage applied. No attempt was made to fix the end of the femur in the acetabulum.

Pathological findings. The specimen consisted of the head and neck of the femur and the synovial membrane. The articular cartilage of the head was badly eroded and detached. Micro-

scopical examination showed synovial tuberculosis and tuberculous erosion of the bone near the surface. The articular cartilage appeared as small fragments imbedded in fibrous tissue.

Two days after the operation the patient showed marked symptoms of iodoform poisoning. At times he was delirious, alternating with stupor. The pulse ranged between 130 and 160, the temperature from 101° to 103°. The urine showed a marked iodine reaction. These symptoms gradually subsided, the wound healed satisfactorily and the drainage tract closed. His weight at this time was 112 pounds.

After several months the patient noticed pain and swelling in the right wrist, and examination showed a localized, fluctuating swelling over the ulnar portion of the right carpal joint. This was treated for several months by the Bier hyperæmic method, and he was then instructed how to continue the treatment himself.

On September 10, 1910, about nine months after the resection of the hip, he had a pulmonary hemorrhage, and examination showed considerable involvement of both apices. He was sent to Dr. Trudeau's sanitarium in the Adirondacks, where he remained until last autumn, when his condition was so much improved that he was permitted to return to New York. He now weighed 143 pounds, he walked easily, without pain and without the aid of a stick. His wrist showed no signs of disease.

This case, Dr. Martin said, seemed to him to be of special interest for several reasons: 1. Recovery after a considerable tubercular infection, with multiple foci in the lungs, wrist and hip. 2. The fact that the patient developed iodoform poisoning, although the amount used was not excessive—less than a drachm. 3. The very excellent movable joint which had been developed, and the appearance of the X-ray showing the margin of the neck resting against the acetabulum, suggesting the formation of a new neck.

DR. DAWBARN said that iodoform poisoning might probably be held identical in symptoms with poisoning by iodine itself, since iodoform was nearly 97 per cent iodine. As to the latter, now so freely used by surgeons in the form of the official tincture upon wound surfaces, it would seem that this could not be free from risk as one factor in the rapid, feeble pulse of shock, especially if some idiosyncrasy should exist. The speaker said he could not forget a case where Dr. Wyeth, many years ago, had

been frank enough to report having caused the death of a patient from acute iodism. It was in the days when the usual treatment for hydrocele, after tapping and emptying, was to inject and leave in the tunica vaginalis sac tincture of iodine. Thus Dr Wyeth did, not using at all an unusual amount. But if this case thus died, was it not advisable to select, especially where there seemed any risk of shock, as in long operations, weak hearts or little children, a means of flushing out the wound for antisepsis more free from risk? The speaker said he thought so, and had for some time past not used the tincture of iodine in these instances, but instead, Burrow's solution of aluminum acetate.

THYMECTOMY FOR TRACHEAL OBSTRUCTION

DR WILLIAM A DOWNES presented an infant, four months old, with the following history. Five weeks after birth, which had occurred at full term and after a normal delivery, the parents noticed that the child coughed occasionally and had some difficulty in breathing. The condition was at first regarded as a cold, and the attending physician made a diagnosis of bronchitis. There was no fever. The dyspnoea was more or less continuous, with occasional exacerbations, especially at night. The breathing was noisy, and, as the mother described it, "whistling" in character. The dyspnoea gradually became more marked, and the child was admitted to the Jewish Hospital in Brooklyn, where he had many attacks of stertorous and whistling respiration but was never cyanosed. The child's digestion was good, and it had gradually been gaining in weight, although the mother stated that during the early part of the illness there had been occasional attacks of vomiting after nursing. The family history was unimportant.

When the child was brought to the Babies' Hospital, on November 15, 1913, it was nine weeks old, and the history dated back about one month. At this time there was continuous dyspnoea, with inspiratory stridor, expiration being free. In crying, the voice was clear, and there was no real hoarseness, and when the child was quiet there was a stridulous whistling sound on inspiration. He had a distinct funnel-shaped chest, and upon inspiration there was a marked depression at the suprasternal notch, and the lower part of the sternum. Percussion revealed dulness over the upper part of the sternum, extending on either side over an area 7 cm wide, and slightly farther to the right side than

to the left This dulness extended as low as the fourth rib on the right side and on the left side merged with the cardiac dulness Otherwise, the physical examination was negative

During the child's first week in the Babies' Hospital there were many attacks of partial suffocation, and one of these nearly proved fatal There was, however, no cyanosis A few whiffs of ethyl chloride appeared to afford considerable relief, and the inhalation of steam seemed to be the most satisfactory treatment

Operation, November 21 Ether anæsthesia A two-and-a-half-inch vertical incision was made in the midline of the neck, extending well down over the sternum The inner border of the sternomastoids was exposed, and the fascia covering the deeper muscles was incised in the middle line The sternothyroid muscles were then separated and retracted, and in the lower angle of the wound the upper pole of the thymus could readily be seen rising and falling with each respiration The gland was covered by its thin, transparent capsule, which was caught between tissue forceps and incised The upper extremity of the right lobe of the thymus was then grasped with forceps, and by gentle traction and wiping the capsule with gauze, this half was removed completely No vessels were ligated The left lobe did not come out with the right, as is frequently the case, so a similar procedure was adopted for its removal, with the result, however, that the lobe broke in two, the lower portion, less than one-half, retracting well under the sternum At this time the trachea came well into view, as did also the left innominate vein, and as there appeared to be no pressure upon the trachea, no further effort was made to remove the remaining portion of the gland The wound was closed with interrupted layer sutures

Following the operation, there was little change noted in the respiration for three days, with the exception of the fact that there were no further severe paroxysmal attacks, with suffocation, such as were present prior to the operation After the third day, however, the breathing gradually improved, and when the child was quiet, breathing was practically noiseless A slight attack of bronchopneumonia occurred during the child's convalescence On the fifth day, there was a rise of temperature and a discharge was noticed from the wound From that time until the wound closed the child was kept in the prone position with the head low, in this way hoping to avoid extension of the infection to the mediastinum That this proved successful was

shown by the fact that the temperature soon fell to normal, and there was no further trouble. The leucocytosis reached 36,000 at the height of the infection, gradually falling to 25,000 and it has since remained about 20,000. This was perhaps accounted for by a slight purulent discharge from one of the child's ears.

Weight of the thymus removed, 7.05 grammes, and the report of the pathologist was, normal thymus gland.

At the present time, eight weeks after the operation, the child seems normal in every way. He breathes freely without effort, and is gaining rapidly in weight and is apparently well.

In connection with this case, Dr. Downes called the attention of the Society to the excellent article on Surgery of the Thymus Gland, by Dr. Charles A. Parker, of Chicago, in the *American Journal of Diseases of Children*, February, 1913.

TORSION OF THE OMENTUM

DR. ELLSWORTH ELIOT presented a man, fifty-seven years old, who was admitted to the Presbyterian Hospital on November 4, 1913, with the history that nine days before he had a sudden attack of pain in the lower right quadrant of the abdomen. The pain was sharp in character, increased by respiration and by movement of the abdomen, and alleviated by rest in bed. After persisting for several days, the pain disappeared for two days, only to recur in the same location. It was not present at the time of the patient's admission to the hospital. There had been at no time any nausea, vomiting, chills, fever nor jaundice. The bowels had been constipated for some time. The patient was said to have had a similar attack nineteen years ago, lasting six weeks. With that exception, he had always been well.

Examination of the abdomen showed a large, smooth, slightly tender mass in the lower right quadrant, and extending for several inches across the median line into the left side. It extended slightly above the level of the navel and could be distinctly felt by rectal examination. It had no respiratory movement, and was flat on percussion. It was elastic in consistency and was regarded as a large abscess connected with the appendix. The blood count, however, showed a general leucocytosis of only 8375, with 75 per cent of polymorphonuclears. The pulse ranged between 80 and 100, and the temperature was normal.

Operation. Through an intermuscular incision on the right side the peritoneal cavity was opened, and was found to contain a

considerable amount of old, partially clotted blood. The mass was found to consist of dark-colored omentum extending across the middle line. The appendix was small, atrophic and slightly reddened, but not distinctly inflamed. It was removed in the usual way. The abdomen was then opened in the midline, below the umbilicus, and the mass of gangrenous omentum—for such it proved to be—was delivered in a twisted condition and amputated. At one point it was firmly adherent to the right, anterior abdominal wall, just to the outer side of the urinary bladder.

After the removal of the omentum, the pelvis was found to be filled with small intestine, very firmly adherent to each other and to the lateral pelvic wall. These adhesions were separated by careful dissection. The transverse colon, to which point the omentum had become gangrenous, was somewhat convoluted and distended, but not obstructed. The abdominal incisions were closed, a drain being inserted into the pelvis.

The patient was somewhat uncomfortable for several days after the operation, being troubled with distention. This yielded to colonic irrigation, and thereafter he progressed satisfactorily until the nineteenth day, when a swelling appeared in the right inguinal canal. This was opened, and several ounces of pus evacuated, from which a culture of staphylococcus was obtained. This abscess must have been the result of a continued necrosis of the stump of the omentum attached so firmly to this part of the anterior abdominal wall. The discharge from the drainage opening was largely serous, with a small admixture of pus, which disappeared about ten days after the operation.

Examination of the omental mass by Dr. Clarge showed a condition of extensive thrombotic necrosis.

DR. FRANK S. MATHEWS said he recently met with torsion of the omentum in a woman with symptoms simulating those of appendicitis. A tumor could be made out. Upon opening the abdomen he found a mass of adherent omentum which had partially rotated from right to left, but was not completely gangrenous. There were no evidences of any attachment outside of the recent adhesions. The appendix was not involved.

DR. ELIOT said that one of the unusual features of his case was the absence of constitutional symptoms in the face of such a grave condition. The patient was able to be up and about for two days after Dr. Eliot first saw him.

pig, his Wassermann showed a 3-plus reaction. In the meantime, however, the thigh became rigid, although no severe strain had been put upon it.

Beginning in September, 1913, very active antisyphilitic treatment was instituted. Mercury was given simultaneously by hypodermic and by mouth, with injections of salvarsan every four to seven days. Under this treatment, the hiatus between the fragments observed by the radiograph gradually disappeared, and was replaced by fairly dense bony tissue. The patient's Wassermann, in the meantime, remained 3 plus.

GALL-STONES IN THE YOUNG

DR. FRANK S. MATHEWS presented a girl, sixteen years old, who came under his observation about three months ago with the history of an acute attack of gall-stone colic dating back one week. There was swelling and tenderness over the region of the gall-bladder, which upon operation was found to contain a calculus impacted in the cystic duct and pathologically showed a pure culture of typhoid bacillus. According to this girl's history, she had never had typhoid fever nor other illness.

Dr. Mathews also reported a second case of gall-stones in a patient 21 years old, and said he thought that at least one-half of the cases upon which he had been called upon to operate for gall-stones were under the age of 30. One was a woman of 24, another was a woman of 26 whose history dated back for a considerable time.

DR. DOWNES showed sixteen gall-stones which he removed last September from a girl thirteen years of age. The case was of acute onset, in fact, it had been regarded as one of acute appendicitis, and it was not until the patient was under the influence of the anæsthetic that the trouble was located in the gall-bladder.

DR. JOHN F. ERDMANN said that fully fifteen years ago he reported a case of gall-stones in the common duct of a young girl aged seventeen, whose history dated back about three years, making her but fourteen years old at the time of onset. Stones were found in the common bile duct and gall-bladder.

DR. MARTIN said he did not think that gall-stones were very uncommon in subjects under the age of 30. Last year he had operated on two such cases, one 22, the other 24 years old, with multiple stones in the gall-bladder.

Dr A T Osgood to catheterize the ureter, this failed, owing to a stricture in the membranous part of the urethra. It was not improbable, Dr Eliot thought, that the infection of the kidney was due to an ascending pyelitis from this source.

DELAYED UNION OF THE FEMUR (SPECIFIC)

DR ELIOT presented a man, twenty-five years old, whose family history was negative, and who gave no history of lues, either inherited or acquired. When a boy, he fractured his left tibia, healing was rapid, but was followed by a persistent, tender, localized swelling. In 1907, a portion of one rib was excised for an acute inflammation. This operation was followed by a sinus.

Present history. In February, 1911, while putting on his shoe, he felt something snap in his right thigh. He was able to walk downstairs, but while returning upstairs his leg gave way under him, the femur fracturing in its lower third. The thigh was put up in a Buck's extension for three months, and then for ten weeks in a plaster case, with absolute non-union.

The patient was admitted to the Presbyterian Hospital on October 10, 1911, where examination showed a fracture of the lower part of the shaft of the femur, with free mobility of the fragments, which were held together by soft tissues. A radiograph showed no callus nor bony deposit. The ends of the bone were in close apposition. A Noguchi Wassermann test was positive.

Up to January, 1912, the patient was given half-grain doses of mercury salicylate intramuscularly every four days, with potassium iodide, up to 180 grains, by mouth, daily. The thigh was fixed in a side splint, and was daily baked and massaged. During this period he also received fourteen injections of 10 c c each of his own blood at the site of the fracture.

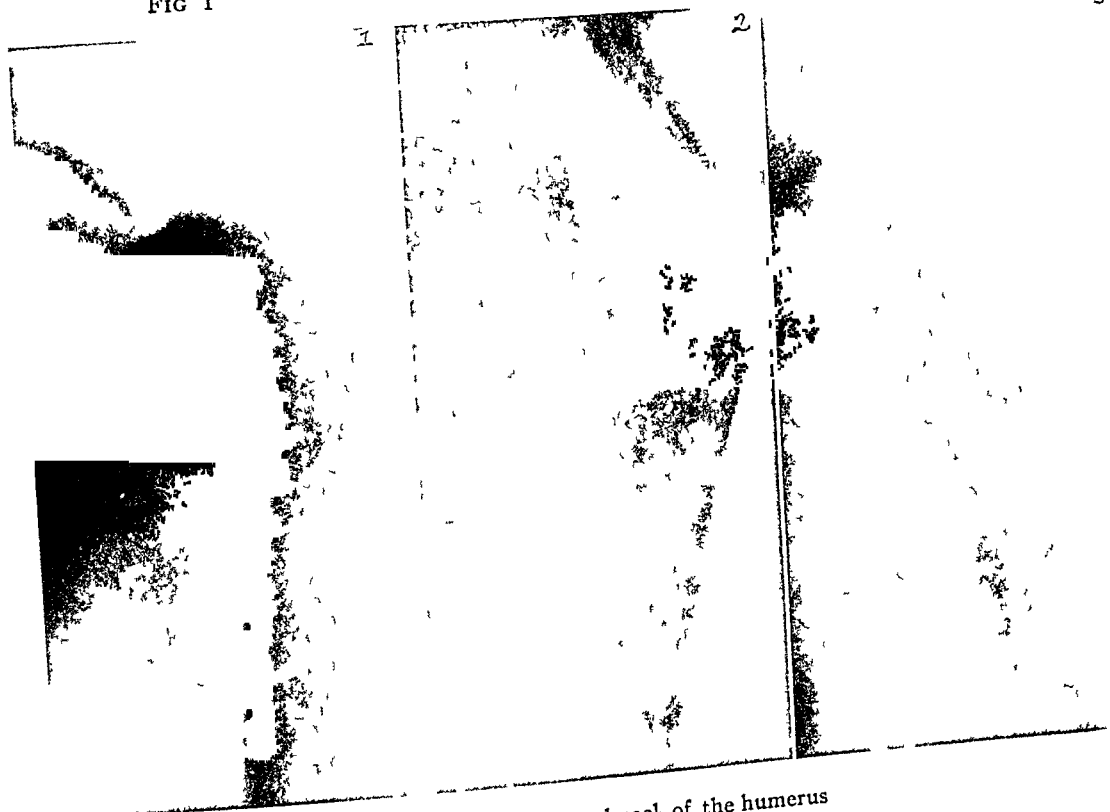
The result of this treatment was practically negative. The thigh was no more rigid than on admission, and the radiograph showed little change in the bone, although his Wassermann was now negative. During the first six months of 1912 he received five intravenous injections of six-tenths of a gramme of salvarsan, and wore a plaster spica. He was then fitted with a walking hip splint and was discharged from the hospital with the thigh considerably firmer, but with slight change in the radiographic picture. He was given occasional doses of salvarsan until March, 1913, when, with the use of an antigen from the heart of a guinea

FIG 1

FIG 2

FIG 3

5



Fracture of the surgical neck of the humerus

removed from the end of the lower fragment, which was then brought into apposition with the upper one and held by a chromic suture passed through the periosteum of the two fragments. The muscles were then sutured with interrupted plain gut, and the skin was closed with a continuous silk suture. A rubber tissue skin drain was inserted, and a dry dressing applied. The arm was held in abduction and flexed to a right angle at the elbow by moulded plaster splints. This dressing was left in place three weeks. (See X-ray Fig 3, taken some weeks later.)

At the present time, January 14, 1914, the patient can abduct the right arm almost to a vertical line, the limitation, as compared with the normal side, being very slight. All other motions are free and apparently normal.

This case, Dr. Lee said, illustrated the difficulty of reduction of fractures of this type without an open operation, and furthermore, it was an example of a case treated successfully without a foreign body splicing the fragments.

A CONSIDERATION OF CERTAIN COEXISTING LESIONS OF THE GALL-BLADDER AND KIDNEY

DR. ELLSWORTH ELIOT read a paper with the above title, for which see page 679.

Dr. Eliot also showed a patient, illustrating the subject of this paper.

DR. ERDMANN said he had recently operated on a man who came to him with the suspicion of having malignant disease of the œsophagus. His chief complaint was pain in the left shoulder. An X-ray was taken, which failed to show any lesion of the œsophagus, but revealed two calculi in the left kidney, and with the removal of these, the man was entirely relieved of his symptoms.

Dr. Erdmann recalled another case where he had operated for gall-bladder disease in a patient who had previously been operated by the late Dr. Edebohl for a renal calculus on the same side.

*Stated Meeting, held at the New York Academy of Medicine,
January 28, 1914*

The President, DR. FREDERIC KAMMERER, in the Chair

SUPPURATIVE OSTEOMYELITIS OF THE TIBIA

DR. JAMES I. RUSSELL presented a girl, four years old, who was admitted to the Roosevelt Hospital on July 18, 1911, with a discharging wound over the left internal malleolus of the left tibia. The child's history dated back three years. When fifteen months old she developed a small abscess behind the left ear. Shortly afterward she began to complain of pain in the right leg, with swelling, redness and tenderness. An abscess developed, which was incised on two different occasions. Later, the left leg began to swell, and an abscess formed over the tibia, this ruptured spontaneously. When admitted to the hospital there was visible a small sinus just behind the internal malleolus of the left tibia which led to roughened bone, and the adjacent bone was thickened and tender.

Operation, July 22, 1911, by Dr. Russell, consisted in the removal of the whole shaft of the tibia with the exception of a small portion of each diaphyseal end, which was not involved in the suppurative process. An incision was made over the anterior surface of the tibia, splitting the periosteum, which was thickened, and which separated easily from the shaft. It was separated throughout its entire extent and the shaft removed by means of a Gigli saw. The periosteum was sutured with catgut and the skin closed, with the insertion of a small rubber tissue drain at the lower angle of the wound. A plaster-of-Paris splint was then applied.

During the course of the child's convalescence, a series of X-ray pictures were taken, which were shown by Dr. Russell with the aid of the lantern-slide to illustrate the gradual re-formation of new bone from the periosteum. The wound was dressed and the sutures removed nineteen days after the operation, and there was primary union throughout. When the patient left the hospital, on February 12, 1912, she was able to walk, and at the present time, two and a half years after the operation, the tibia was prac-

The temperature reached normal on the second day after the operation, and the patient's convalescence was uneventful.

The series of X-rays showed a developing bone which had not yet completely re-formed. Dr Russell said that after waiting for some time, if the bone did not completely re-form, he would do a bone graft.

RE-FORMATION OF TIBIA AFTER OSTEOMYELITIS

DR WILLIAM A. DOWNES presented this case, with lantern slide illustrations (Figs 1-4). The patient was a girl, eight years old, who was admitted to St Francis Hospital on March 13, 1912, with the history of pain and swelling in the left leg, just below the knee, of one week's duration. The temperature, on admission, was 102°, pulse 140, and the child was apparently very ill. Examination showed a spindle-shaped swelling involving the upper part of the leg.

Under general anæsthesia, a four-inch incision was made over the anterior surface of the leg, and a large amount of pus evacuated. The epiphysis and upper half of the shaft of the tibia were entirely bared of periosteum. The wound was left open. The child's condition improved, and on April 3 the incision was carried down to the lower epiphysis of the tibia, and a subperiosteal resection of practically the entire shaft of the bone was done. A small portion of the upper and lower ends of the diaphysis were apparently healthy, and these were left. As there were no symptoms of infection at this time, the wound was closed and a plaster-of-Paris case applied. The wound healed rapidly, and by July 3 the X-ray showed considerable bone formation.

On November 23 the picture showed that regeneration of bone was proceeding rapidly, but that non-union existed between the newly formed bone and the upper remaining portion of the tibia. The condition was practically unchanged on December 26, 1912.

On the 18th of the following February, when the child was re-admitted to the hospital, there was marked regeneration of bone, but the point of non-union was still present. A bone graft, an inch and a half long, was removed from the opposite tibia and inserted at the point of non-union, and the plaster case re-applied.

On March 10, 1913, the wound was healed throughout, and the X-ray showed some new formation of bone at the site of the

graft By May 17, there was firm union at this point, and by July 21, the tibia was re-formed throughout The plaster was then removed, and a hip splint applied

At the present time (January, 1914) the X-ray showed a perfectly solid tibia, at least two-thirds the size of the normal bone, and the point at which the graft had been inserted could no longer be made out The knee and ankle joints were in perfect condition, there was no shortening nor deformity, and the child had complete use of the limb

DR CHARLES N DOWD asked in which class of cases it was best to do a complete subperiosteal resection of the diseased bone, instead of leaving a thin shell of bone to help maintain the shape of the bone and assist in its re-formation, as had been recommended by some, who claimed that this latter method gave better results, and that complications were less apt to occur In one case, Dr Dowd said, where the entire bone was bathed in pus, he left a thin, posterior shell of bone, and his results, he thought, were better than if the entire bone had been resected Shortening was less likely to occur, and the re-formation of bone progressed more rapidly

DR RUSSELL said that in the very acute cases, such as one of those he had shown, where the operation was done about six weeks after the onset of the disease, he sutured the periosteum and also the external wound, leaving only a small drain In this case there was slight suppuration of the skin wound, but this subsided in a few days and the wound then closed In one of the other cases he closed the wound entirely and primary union followed This of course was unusual in osteomyelitis, and he had emphasized it for that reason There had been no complications in any of his cases, barring the fracture of the thigh in one case, which was of course purely accidental

As for leaving a thin shell of bone, as suggested by Dr Dowd, it seemed to him extremely difficult to accomplish this in dealing with a diseased tibia without fracturing the bone His own results had been better by doing a complete subperiosteal resection than by the older methods

DR DOWNES said that in his case, at the time of the second operation, the child showed every evidence of having had a severe infection, and the blood supply of practically the entire diaphysis had been cut off The section of the tibia that he had removed

looked like perfectly dead bone, and in this case, at any rate, there was no possibility of leaving a posterior shell. The importance of leaving the periosteum was well illustrated by comparing the result in this case with one that had come under his observation where the periosteum was evidently destroyed, and a complete loss of the diaphysis resulted. The patient had a six-inch shortening and a useless leg.

DR ARPAD G GERSTER said the patients shown were all children, in whom the process of bone regeneration was much more active than in grown people. The character of the attacks, too, was apparently of a comparatively mild type. In some cases of osteomyelitis the patients were so extremely ill and the destruction of tissue so extensive that this method of treatment could not be carried out at all, for example, in very septic cases, with a gangrenous periosteum, and great destruction of tissue resulting from tension. In the milder cases, the old-time methods of treatment would probably have given equally good results. This new method was particularly indicated, he thought, in old, sluggish, chronic cases, with discharging fistulæ, the patients wandering from one hospital to another and remaining uncured until the nidus of infection was radically removed.

This entire subject, Dr Gerster said, was a very important and interesting one, but we should not lose sight of the fact that we could not resect and save every bone in osteomyelitis. We could not generalize, every case had to be treated on its own merits, this by one method and that by another. More study of the varieties of suppurative osteomyelitis, and more precision as to an intelligent indication based on pathological condition, were necessary.

ARTERIOVENOUS ANEURISM OF THE SUPERIOR THYROID ARTERY AND VEIN

• DR WILLIAM A DOWNES presented a woman, thirty-five years old, unmarried, who was admitted to the New York Hospital on April 22, 1913, with the history that seven years ago she was operated on for goitre in a hospital in Pittsburgh. Judging by the history, the goitre was probably of the exophthalmic type and about the size of an orange. Six months later she began to notice a throbbing in the right side of the neck, occasionally accompanied by a sharp pain. This continued until about four years ago, when

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she had a severe, sudden, sharp pain which lasted several days, and was soon followed by a swelling in the right side of the neck. Accompanying this swelling was a purring sound. The swelling gradually increased until it reached the size of a goose egg.

Examination at the time of the patient's admission to the hospital showed the usual signs of an aneurism, and from its location it was thought to spring from the common carotid artery. However, on operation, which was done by Dr. Downes on April 22, 1913, the aneurism was found to have formed between the superior thyroid artery and vein, and he was able to ligate the artery between the external carotid and the aneurism, and similarly the vein leading into the aneurism, and then remove the aneurismal sac *in toto*. It was about the size of a hen's egg, and besides the artery and vein, entering the proximal pole of the sac, there were two small vessels attached to its distal end which disappeared under the muscles across the median line. The patient made a perfectly satisfactory recovery.

ARTERIOVENOUS ANEURISM OF THE FEMORAL ARTERY AND VEIN

DR. GEORGE D. STEWART presented a police officer, thirty-eight years old, who, in July, 1911, while making an arrest, was shot five times, three of the bullets entering the arm, one penetrating the lower part of the abdomen and one the groin. As a result of the latter, he developed a tremendous hæmatoma of the scrotum, and when he left the hospital at the end of 46 days, there remained a tumor in the right femoral space, which was recognized as an arteriovenous aneurism.

When Dr. Stewart first saw the patient, in November, 1911, this tumor in the right femoral region was present. It gave a distinct thrill, and was undoubtedly a communication between the right femoral artery and vein. As a preliminary measure, continuous pressure was applied over the swelling with little or no effect.

Operation, December, 1911. Upon exposing the tumor, the artery and vein were found lying side by side, and merged for a distance of about three inches. Instead of proceeding in the usual way, Dr. Stewart said he acted upon a suggestion made by his assistant,

Dr Arthur M Wright, and created a new partition between the artery and the vein by taking a fine needle, similar to that used by Carrel in doing his arterial anastomosis, and inserting a double row of sutures between the two vessels. The needle was passed back and forth, the interrupted stitches being placed very close together, covering the entire distance where the vessels were merged together, until finally the thrill in the artery ceased. By this method the vessels were not opened, and no blood was lost. Since the operation, which was done in December, 1911, there had been no return of the thrill, and the patient had remained entirely well.

Pulsation in the artery below the aneurismal communication was noted during and after the operation, when it was apparently increased in volume. As the pulsation still persists in popliteal, dorsalis pedis and posterior tibial there has probably been no clotting at the site of operation.

Dr GERSTER said the case shown by Dr Stewart was certainly treated on very original lines, and as far as safety was concerned, it was very commendable, as the interior of the blood-vessels was not invaded. It would be interesting to study the specimen of a case thus treated. Evidently a collateral circulation had been established before this aneurism developed, and the result, perhaps, would have been just as good if the vessels had been tied.

EXCISION OF GASTRIC ULCER, FOLLOWED BY HOUR GLASS CONTRACTION OF THE STOMACH

Dr F KAMMERER presented a patient who had come under his care a year ago for a chronic ulcer of the stomach. At operation, a perforating saddle-ulcer, involving more of the posterior than the anterior surface of the stomach and firmly imbedded in adhesions, was found about midway between the cardia and pylorus on the lesser curvature. The ulcer was removed by a wedge-shaped excision, taking in about two-thirds of the transverse diameter of the stomach. After the defect in the latter had been closed by several rows of sutures it was evident that considerable tension was now exerted upon the pylorus, but the condition of the patient was such that an additional gastroenterostomy was deemed inadvisable. A small tampon was introduced for a few days through the upper angle of the wound. The patient's recovery was rather stormy, a large intra-abdominal

abscess forming on the right side, which had to be opened at the end of the second week. Finally, healing took place, but after half a year the patient was again put on the operating table for gradually increasing symptoms of gastric retention. At the second operation, what appeared to be a normally shaped stomach, somewhat small, was found firmly fixed by adhesions against the posterior abdominal wall and spinal column. A posterior gastro-enterostomy being out of question, the anterior operation was done with a Murphy button, and an entero-enterostomy added. The desired effect did not follow this procedure, although the button was passed during the second week. The condition of the patient grew steadily worse. He lost weight, was nauseated after meals, vomited frequently, and was greatly relieved by lavage of the stomach. X-ray examination showed a dilated stomach lying somewhat to the left of the median line, filled with bismuth, and an intestinal shadow, beginning about three inches above the lowest point of the stomach to the right, giving the impression of a contracted gastro-enterostomy opening. At a third operation during November, the anastomosis between the stomach and intestine was found to easily admit two fingers, the pylorus was open and the stomach appeared as it did at the last operation, about six inches long and three or four inches wide, with a well-developed larger curvature meeting the lesser curvature in dense adhesions beneath the left costal border. To expose all these parts a great many adhesions had to be separated, and, thinking that the latter had perhaps prevented the proper functioning of the entero-enterostomy and had established a kind of vicious circle, the stomach was divided near the pylorus and both ends closed in the hope of forcing the gastric contents through the gastro-enterostomy. There was not the slightest amelioration in the patient's condition following this third operation. Several further X-ray plates were taken. On comparing these with the former plates, the speaker was, for the first time, struck by the fact that the stomach in the plates was invariably situated further to the left than he had found it at operation, and then, also for the first time, the possibility that we had been dealing with two different cavities at the X-ray examinations and the later operations suggested itself. A fourth operation cleared up the situation entirely. After separation of dense adhesions to the left, the cardiac pouch of an hourglass stomach was exposed. A second gastro-enterostomy was

done, uniting this pouch with a lower coil of intestine, and also a second entero-enterostomy. The patient was immediately relieved of all his symptoms.

After the first gastro-enterostomy, the efferent loop of jejunum had been drawn over by adhesions to the left, toward the cardiac pouch of the stomach, and, when later on a bismuth meal was given, a small portion of the latter evidently passed into the pyloric pouch and then into the efferent loop of jejunum, giving the impression on the X-ray plate that the anastomosis was situated at the point where this loop was attached to the cardiac pouch. In reality, gastro-enterostomy had been done with the pyloric pouch. The case demonstrated the difficulties of secondary operations after extensive adhesions in the abdominal cavity, and also difficulties in the way of a correct interpretation of some X-ray plates.

DR GERSTER said some very practical conclusions could be deduced from the case shown by Dr Kammerer. One was the great importance, when the abdominal cavity was opened, to ascertain the anatomical condition of the parts under the guidance of the eye—not touch alone. This fact had been impressed upon him many years ago, when, after removing a tumor of the caecum, he trusted to his sense of touch in making what he supposed to be an anastomosis, instead of which he formed a vicious circle which resulted fatally.

Dr Gerster said that in two cases of saddle ulcer located on the lesser curvature of the stomach, he had followed practically the same procedure as that described by Dr Kammerer, and after the excision of a large segment of the stomach wall, the normal configuration of the stomach was lost, and in one of the cases, where death occurred five days after the operation, the autopsy showed that the lesser curvature was entirely absent. In both of those cases he did a gastro-enterostomy. In a recent case, the ulcer was located midway between the pylorus and cardia, closely approaching the site of a previous gastro-enterostomy. A resection was contemplated, but how to proceed was rather puzzling. Posteriorly was the stoma of the old gastro-enterostomy, and in order to leave this undisturbed he cut through the pylorus and did a right-angled resection, leaving a stomach that resembled a segment of large intestine. In this case, malignancy was subsequently demonstrated in the specimen.

DR HOWARD LILIENTHAL, speaking of the trouble given the

sions that Dr Kammerer had encountered, said he was inclined to believe that if gauze packing was prevented from coming in contact with the gut throughout the entire operation, the subsequent formation of adhesions, particularly in the upper abdomen, would be minimized. To prevent this contact between the gauze and abdominal contents, he had found the suggestion made by a writer many years ago an excellent one. It consisted in the use of a strip of stout rubber dam, into this a small hole was punched, and through this opening (stretched) the tissue or organ upon which it was intended to operate was drawn. This gave an absolutely clean field, and when the operation was complete the parts were returned to the abdominal cavity without the hand or gauze having come in contact with the peritoneum. Nothing but retractors, rubber gloves and instruments.

DR JOHN A HARTWELL said he recently had a case very similar to the one shown by Dr. Kammerer, where a large saddle ulcer extended from the pylorus over both the anterior and posterior walls of the stomach. In that case he did a resection much like that described by Dr Gerster, and closed the upper end of the pylorus. He then did a posterior gastro-enterostomy. The immediate result of the operation was good, but death occurred within a few days, and the autopsy showed that while the wound in the stomach had healed satisfactorily, there had been a severe peritonitis in the lesser sac. In this case, a preliminary gastro-enterostomy had been contemplated, but the patient's suffering was so intense that it was decided that it would not answer the purpose.

DR DOWNES said that about four years ago he looked up the subject of hour-glass stomach, and found at least half a dozen cases reported in which gastro-enterostomy had been performed where the distal pouch had been used instead of the proximal in forming the union between the intestine and stomach, with the result that the cases had gone on to fatal termination. He thought Dr Kammerer was to be congratulated upon making the discovery early enough to correct the condition and save his patient.

DR KAMMERER, in closing, said he thought the adhesions in this case were due to the large intraperitoneal abscess which formed after the first operation. He agreed with Dr Gerster that of the field of operation as possible should be brought

under the eye, but in this instance the adhesions were so abundant and firm that he did not feel justified in trying to separate them during the later operations without a distinct indication

RESECTION OF THE FEMORAL VEIN FOR THROMBO-ANGEITIS OBLITERANS

DR. HOWARD LILIENTHAL presented a man, thirty-two years old, who was admitted to the Mt Sinai Hospital on November 15, 1913, suffering from a thrombo-angitis obliterans affecting both lower extremities. Five years ago he had been a patient there with the same disease, and was discharged unrelieved. Two years ago he had returned to the hospital complaining of numbness and pain in the left foot, his previous trouble having been limited to the right foot. He remained in the hospital almost a year, and during that time four toes on the left foot and one toe on the right foot were amputated. With very slight remissions, the symptoms had progressed, an ulcer at one of the cicatrices of the left foot having failed to heal, and giving rise to constant, severe pain. He also complained of numbness in his fingers.

At the time of his present admission there was no pulsation in either foot. The feet were much reddened. The veins in both lower extremities were apparently very small, and there was an ulcer the size of a silver quarter of a dollar in the line of the former amputation. The pulse was 120, respirations, 24, temperature, 100.6°. The urine was normal.

The patient was seen by Dr. B. Sachs, who expressed the opinion that it was one of incipient Raynaud's disease. The pain was excessive, and could not be relieved by any form of dressing. The patient having expressed a desire for amputation, Dr. Lilienthal advised arteriovenous anastomosis as a preliminary measure, with the hope of postponing the necessity for amputation.

Operation, December 8, 1913. Upon exposure, the femoral artery was found to be of normal size, the only apparent abnormality being the increase in the number of vasa vasorum. The femoral vein, however, at the beginning of Hunter's canal was very much smaller than the artery, and its walls were greatly thickened. The operation originally planned, therefore, was abandoned, and the femoral vein was doubly ligated and a section removed between the ligatures. The operation of ligating the femoral vein in this condition, Dr. Lilienthal said, had been

advised by Coenen and others (See Dr Leonard Freeman's paper, *Trans Amer Surg Assoc*, 1913) The wound was closed by deep and superficial sutures

There was no particular change apparent in the circulation of the foot immediately after the operation A few days later, however, the patient stated that there was some relief from the intense pain, and the circulation of the foot was certainly no worse than it was prior to the operation From this time on the patient improved rapidly and, by January 20, 1914, the ulcer had practically healed, the pain had entirely disappeared and the patient insisted on returning to his home

THROMBO-ANGELITIS OBLITERANS MULTIPLE LIGATION OF VARICOSE VEINS OF THE LEG

DR LILIENTHAL presented a man, fifty-one years old, who for three years had suffered from the characteristic pain and other symptoms of a thrombo-anginitis obliterans The left foot was the one principally involved The pain extended up the calf of the leg, and became so severe that amputation was consented to

On December 26, 1913, it was Dr Lilienthal's intention to ligate the femoral vein, but after the patient was on the table it was decided instead, as a preliminary measure, to ligate the large, multiple varicose veins of both legs, and this was accordingly done by Dr Ira Cohen, the house surgeon Following this procedure, the patient was completely relieved of his symptoms, and left the hospital about two weeks after the operation

Dr Lilienthal said that in both of these cases, as, in fact, in all the cases that had come under his observation, the patients were addicted to the excessive use of cigarettes

DR WILLIAM C LUSK said he thought the probable syphilitic nature of endarteritis obliterans should be taken into consideration In the case he had shown before the Society last spring (*ANNALS OF SURGERY*, November, 1913, p 670) in whom the symptoms had been relieved and function was becoming restored in conjunction with the use of the Schnee four-cell electric bath, during the past summer the sinus in the little toe had grown larger and bone became exposed in its bottom, and there was some slight return of the pain, which, it seemed, could practically be held in abeyance the daily use of the electric bath Mixed treatment for about 4 weeks, followed by neosalvarsan 0.45, had caused no marked improvement, but after a second dose of salvarsan (old) 0.2 the sinus

quite suddenly, in the course of 10 days, healed up completely. Also the tendency to pain then promptly diminished and, with regular injections of mercury and an occasional salvarsan, disappeared completely. This patient had a history of syphilitic infection, but his Wassermann, on repeated taking, had always been negative or doubtful. In a second case referred to him by Dr C. G. Burdick, treated with the electric bath, while the pain was generally relieved for a number of hours following the bath, yet the foot was very swollen and a commencing gangrene spread, so that the foot had to be amputated. The treatment of two other cases had been begun about two weeks previously. One of these, referred by Dr H. H. Janeway, had a history of syphilitic infection 9 years ago, though the Wassermann was now negative. The left foot had been amputated. The right foot was a little swollen and on the inner side of the great toe there was an ulcer about $\frac{1}{2}$ inch in diameter, of 4 weeks' growth, and in and around the great toe there had occurred attacks of burning pain for 3 weeks, mostly at night. The treatment had consisted of intramuscular injections of salicylate of mercury at five-day intervals, 10-grain doses of potassium iodide, and a daily four-cell electric bath. At the present date the ulcer had already scabbed over and was now perfectly dry, and the foot was no longer swollen. For the past two nights the patient had slept in perfect comfort.

NOTE—February 13, 1914. The patient is now entirely free from pain and is active. Baths stopped February 3. Antispecific remedies continued.

The other case was one in the service of Dr T. A. Smith at Bellevue Hospital and was of an advanced type. He had, before the present treatment, suffered uninterrupted pain for 9 months, the great toe had become gangrenous, the adjoining skin was cyanotic and the whole foot swollen. Wassermann strongly positive. In the past 2 weeks the patient had been given injections of mercury, small doses of potassium iodide and a daily electric bath, with the result that following the bath there had generally resulted several hours of respite from pain. Dr Lusk said that the electric bath for the relief of pain in these cases was best used with a current of 10 ma. for 10 minutes.

Dr A. V. Moschcowitz said he had long been under the impression that this was a disease in which syphilis could be ruled out. They saw many of these cases at Mt. Sinai Hospital, and most of them did not give a syphilitic history.

Wassermann reaction positive Because some of these patients were improved by mixed treatment and salvarsan, it did not prove that they were necessarily syphilitic, and if the Wassermann was negative, we might safely assume that syphilis could be ruled out. The disease seemed to be especially prone to occur in men of Jewish extraction who were heavy cigarette smokers, but a number of cases had been reported by the surgeons in soldiers of Christian and Mohammedan religions, who served in the recent wars in the East.

DR GERSTER said that Dr Leo Buerger had recently written a very creditable work on the subject of this disease, but the result of his pathological studies still left us in the dark as to the essential etiological factor that gave rise to it. Whether it was tobacco, race, or syphilis, we did not know. We did not know why the blood-vessels of these particular patients degenerated in this particular fashion. Dr Lilienthal had presented several cases where interference with the venous circulation produced a marked improvement in the subjective symptoms of the disease, of which the predominating symptom was the pain, which was so intense and persistent that the patients could not get any relief without the aid of opiates. Why should the resection of the veins relieve the pain? In other cases that had been reported, an arteriovenous anastomosis had produced a similarly beneficial result. Lacking a better theory, Dr Gerster said, he would make the suggestion, that as most of these patients were extremely neurotic, and not of the phlegmatic type, that is over-sensitive to pain, it might be assumed that this or any other form of operative treatment acted the line of suggestion analogous to the temporary relief from epilepsy after certain operations on the skull or elsewhere.

DR HARTWELL said they had one case of endarteritis obliterans, at Bellevue Hospital, where one leg had to be amputated and the other was affected. That patient had never smoked, while his father, who was an inveterate smoker, had lived to the age of 83 without developing this disease.

DR LILIENTHAL said that in all of their cases the usual tests for syphilis had been made, with negative results. While they had not tried the electrical baths, to which Dr Lusk referred, they had tried electricity without any benefit.

Replying to Dr Gerster, the speaker said this was a disease of men, not women, and the latter were generally more neurotic than the former, and for that reason he thought a neurosis could be

ruled out Besides, a neurosis would not explain the pathological changes found in the arteries In two of the cases he had seen, the patients subsequently became insane, possibly from arterial changes in the brain In addition to the pain, the appearance of the extremities indicated some real pathological condition, and in one of the cases examined by Dr Buerger, there was ossification and obliteration of the vessels Aside from arteriovenous anastomosis and the relief following the operative procedures in the two cases shown to-night, amputation had hitherto been the only recourse

DR. GERSTER said he did not wish to be understood as claiming that this malady itself was a neurosis, only that the excessive pain was possibly neurotic in character The operation described by Dr Lilienthal was certainly a valuable addition to our knowledge in the treatment of these cases, even if the results obtained by it could not be explained on pathological grounds

ANTERIOR DISLOCATION OF THE HEAD OF THE RADIUS, WITH FRACTURE OF THE ULNAR SHAFT OPEN REDUCTION

DR WILLIAM DARRACH presented a girl, four years and five months old, who on May 25, 1913, fell off a toy wagon, striking her forearm on a stone The forearm was put up in splints within a few hours after the accident, and four weeks later, when the splints were removed, motion at the elbow was found to be limited

A week later, a number of X-ray pictures of the joint were taken for the first time, and the patient was referred to Roosevelt Hospital At this time, flexion at the elbow was possible to 80 degrees (10 degrees beyond a right angle), and extension was possible to 160 degrees (within 20 degrees of a straight angle) Pronation and supination were both limited to one-half the normal degree, and the head of the radius could be distinctly felt displaced forward The X-ray showed a fracture through the upper part of the ulna, with moderate anterior bowing On July 2, thirty-eight days after the injury, under gas and ether anesthesia, a curved incision was made over the dorsal, lateral aspect of the forearm, extending from the line of the elbow joint downward for a distance of three inches The ulnar fracture was broken up, and the head of the radius approached from behind the radial carpal flexor The radial head was found lying anterior

to the capsule. An attempt was made to reduce the dislocation by traction, but the opening in the capsule was too small to admit the head.

A vertical incision was made through the orbicular ligament, and a chromic suture passed through the mesial edge. This was then passed around the neck of the radius from behind forward, and to its inner side, the orbicular ligament being thus drawn around the head and neck of the radius, the latter easily slipping back into its normal position. The suture was then passed through the lateral edge of the cut ligament and tied, approximating the cut edges. The wound was then closed, using catgut for the deeper planes and silk for the skin. A plaster bandage was then applied, extending from the middle of the arm to the metacarpal region, with the elbow at right angles. The plaster was removed after three weeks, when the wound was found healed and the stitches were taken out. Flexion was now possible to 70 degrees, extension to 150 degrees and supination and pronation each one-quarter. The X-ray showed that the radial head was in its normal position, with good alignment of the ulna. A week later flexion was still limited to 70 degrees, extension to 170 degrees, while pronation and supination had increased to one-half the normal amount. On January 28, 1914, almost seven months after the operation, flexion was possible to 30 degrees, extension to 200 degrees, (20 degrees beyond a straight angle), while pronation and supination were complete and there was no pain or decrease in power. The radial head could be felt in its normal position.

FRACTURE OF THE ASTRAGALUS, WITH DISLOCATION BACKWARD OF THE POSTERIOR FRAGMENT. REMOVAL OF THE FRAGMENT

DR. DARRACH presented a man, twenty-two years old, who on March 17, 1913, while attempting to climb on a moving wagon, caught his foot in the spokes of the wheel. The foot was forcibly everted and rotated outward, and was said to have been dislocated outward, the skin over the internal malleolus being broken. He was taken to a hospital, where the foot was pulled back into position and bandaged, and on the following day he was allowed to go home. Eight weeks later he came to Roosevelt Hospital complaining of inability to walk because of pain below the internal malleolus and in front of the tibiotarsal joint. On examination, the right ankle was widened in the region of the malleoli and for a distance

of an inch below Just anterior to the tendo Achilles there was a firm swelling, the size of a golf ball, which was very slightly movable on the underlying parts It was not adherent to the overlying skin There was no motion at the tibiotarsal joint, and the movements at the mid-tarsal joint were greatly limited There was a scar just above the tip of the internal malleolus Just underneath this there was marked tenderness, as well as over the lower tibial margin in front The head of the astragalus could be felt in its normal position An X-ray examination showed that there had been an oblique fracture of the astragalus, the anterior fragment consisting of a head, neck and the portion of the body adjacent to the interosseous groove The rest of the body, containing the tibial, fibular and posterior calcaneal articular surfaces, had been displaced backward There was also a fracture of the lower extremity of the tibia involving the internal malleolus and adjacent portion of the anterior lip

On May 16, 1913, under gas and ether, a curved incision was made behind and below the internal malleolus, and the posterior fragment shelled out of its bed and removed After the removal of this, as the foot could now be flexed and rotated inward sufficiently to bring it well under the axis of weight-bearing, it was decided to leave the anterior fragment in place and see how much functional return would result The wound was closed, and the foot and entire leg inclosed in a plaster-of-Paris bandage, the foot being flexed and inverted as much as possible There was no reaction after the operation, and the patient left the hospital at the end of a week The plaster was taken off at the end of three and a half weeks, when the stitches were also removed, the wound having healed primarily

The patient returned to work three months after the operation, but still complained of pain referred to the front of the tibiotarsal joint He then had 20 degrees of motion at this point Six months after the operation there was still some pain below and in front of both malleoli when he first began to walk on it each day This disappeared after about fifteen minutes, and did not return until after six or seven hours of continuous work Building up the inner side of his shoe and the wearing of a metal arch support had decreased his pain and improved his gait Four months after the operation there was almost no pain in the ankle, and he walked without a limp There was still a little pain when he first began to use it in the morning

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ORIGINAL MEMOIRS.

THE PROPHYLAXIS OF CANCER.

BY WILLIAM J MAYO, M D,
OF ROCHESTER, MINNESOTA.

ALL vertebrate animals suffer from cancer in situations which are affected by their habits or conditions of life leading to local lesions in the protective mechanism. We must, therefore, look upon local lesions as an invitation to cancer without regard to just what the actual cause of cancer may be.

If parasitic agencies are the cause of cancer it would appear that their introduction into the human economy was affected through local lesions. The strongest evidence as to the parasitic nature of cancer and the best research on the problem with which I am acquainted is the work on the production of plant cancer by Erwin Smith,¹ which agrees in its main essentials with what we know about cancer as it exists in the human race.

On the other hand, if the cancerous process is one which is brought about by failure to restore normal conditions at the site of a local lesion by means of mature cells and the eventual calling forth of partially differentiated cells of an embryonic type in response to continued irritation, the rôle of the local lesion in either case is as important as is the actual cause.

It is probable that a large majority of human beings possess an immunity to cancer, that a lesser number possess

* The President's Address before the American Surgical Association, April 9, 1914.

The speaker said he was strongly in favor of the preliminary use of the X-ray in all these cases as a routine diagnostic precaution. When he has to deal with a badly infected bladder, he tries to improve the patient's condition before doing the suprapubic operation. During the first stage of the operation, if the hemorrhage was alarming, you knew where to look for it, which was not the case when the operation was completed at one sitting.

DR LILIENTHAL also showed a series of X-ray pictures demonstrating changes in the prostate. In these plates exposure had been made with the bladder full of air and the contrast with the solid prostate was well marked. The method had been devised by Dr A. Hyman and it formed an additional means for pre-operative exact diagnosis.

NOTE.—It has been since ascertained that a similar method was employed by Burkhart and Florken (*Deut. Zeit. f. Chir.*, vol. 105). They made use of oxygen gas instead of air.

DR A. HYMAN (by invitation) said the expedient of filling the bladder with air, as a diagnostic aid in prostatic enlargement, was revealed to him by accident. He had a patient, a man about sixty, in whom calculus was suspected, and it was suggested to dilate his bladder with air in order to bring the outlines of the stone out more distinctly. The X-ray failed to show a calculus, but showed very clearly the outlines of an enlarged prostate. Since then he had resorted to this method in half a dozen cases, and in all of them the enlarged prostate was very distinctly shown. The measure was of course indicated in patients who could not be cystoscoped and where the enlargement of the prostate per rectum was comparatively slight. The radiographs were taken by Dr. Jachs of the Mt. Sinai Hospital X-ray department.

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malignancy Keen,⁴ in 1904, called attention to the danger of degeneration of local lesions of this character and presented most interesting and instructive data in regard to their relation to cancer Bloodgood,⁵ in recent years, in a series of remarkable papers on the cancer problem, points out that of 820 pathologically fully developed cancers of the skin and visible mucous membranes, he was unable to find a single case with a well-taken history which showed the absence of a previous defect which might be looked upon as a precancerous lesion

(2) *Trauma* Coley⁶ calls attention to the influence of trauma not only in the development of sarcoma, which has been an accepted fact for a generation, but also to the fact that trauma has a strong influence in the production of carcinoma Coley made an analysis of 250 cases of carcinoma which came under his personal observation and the histories of which were taken by himself There was a history of antecedent trauma in 32.8 per cent of the cases The influence of trauma in the production of cancer has also been pointed out by McWilliams,⁷ von Bergmann,⁸ Ropke,⁹ Murphy,¹⁰ Ziegler,¹¹ Lowenthal,¹² Liebe,¹³ von Graefe,¹⁴ and others

(3) *Chronic irritation*, whether the result of mechanical, chemical, or infectious agencies, is the most important of all those precancerous conditions with which we are acquainted and it is undoubtedly the most potent influence in the development of the disease following congenital lesions and trauma It is to be noted that cancer in any part of the body which is open to inspection may be shown, in practically every instance, to be preceded by a local lesion The following well-attested examples may be cited: The development of cancer in the mouth from betel-nut irritation, the cancer of the groin in the chimney sweeps and sailors; the development of cancer following the chemical irritation caused by tar, paraffin, petroleum, arsenic, and aniline products, the development of cancer in local lesions produced by heat, as cancer of the lip from smoking, the "kangri" sores following burns, those cancers of the

a partial immunity, while a minority are without those protective agencies which render the local lesion ineffective. The term "precancerous," while not strictly accurate, has become allowable through custom and graphically describes a clinical condition, as pointed out by Rodman ²

The clinician can say with a great deal of assurance that a certain lesion is benign, that another is malignant, but there still exists a number of mid-ground lesions of which he is unable to say that they are either benign or malignant

The pathologist, by microscopic examination, can, in a much higher percentage of cases, definitely establish the benignity or malignancy of a growth. But, there occur certain growths which, even upon minute investigation, he will be unable to diagnose positively as benign or malignant. Sections from such growths sent to different pathologists may bring back contradictory opinions, the majority being undecided

The microscopic picture which exists in these cases shows a change in character of the cells quite different from the normal but as yet showing no invasion of the surrounding tissues ³. This invasion is held by most pathologists to be essential in establishing malignancy. Pathologists, however, are striving to establish criteria whereby the change in the character of the cells may be shown to indicate malignancy before invasion takes place. Such microscopic appearance is found in the periphery of malignant growths and in chronic lesions which have been known to later develop malignancy. *The term "precancerous," therefore, strictly should not be applied to all local lesions which may be followed by cancer, but only to those local lesions in which cellular changes are taking place that surpass the normal attempt at repair of the lesion itself, but which are not as yet infiltrating surrounding tissue, the local lesion acting as the invitation, the precancerous stage as its probable acceptance*

Sites of local irritation may be divided into three general groups

(1) *Congenital* or acquired neoplasms, such as moles, warts, and benign tumors of various sorts which may undergo

of all congenital or acquired local lesions such as Keen and Bloodgood have shown to be prolific forerunners of malignant degeneration, and the careful observation of patients for early evidences of malignant change following trauma.

Can our knowledge of the development of external cancer be applied to the solution of the problems of the development of internal cancer? Admitting that the mass of evidence as to the rôle of chronic irritation in its various forms and types is the most important factor in the development of cancer in the parts of the body which are exposed to the eye, must we not conclude that cancer on the inner surfaces of the body depends on the same precancerous conditions? It is difficult to develop evidence as to the early appearance of cancer on the internal mucous surfaces of the body because in the early stage there are, as a rule, no manifestations which lead to a visual examination. Yet we have seen a very considerable number of such early cases and we have observed no instances of early cancer in the mucous membrane of the inner surfaces of the body which did not show the presence of a previous local lesion.

In nearly all the cases of cancer of the gall-bladder which we have had an opportunity to carefully examine, gall-stones were either present or there was evidence to show that they had been present (Fig 1) ²²

One is impressed with the collateral evidence that the incidence of gall-stones and cancer of the gall-bladder shows the same increased frequency in the female over the male. Can we doubt that early removal of gall-stones might prevent cancer of the gall-bladder? The mortality of an early operation for gall-stones, other things being equal, is less than 1/2 per cent. Cancer of the gall-bladder occurred in nearly three per cent of all the cases of cholelithiasis which came to operation in our clinic. We have had no permanent cures after cholecystectomy for cancer of the gall-bladder which had been diagnosed as cancer previous to operation. A number of cures have followed the removal of early cancer incidental to the removal of thick-walled functionless gall-bladders, thus,

showing that it is not the nature or situation of the malignant process but the delay in diagnosis which is so fatal.

Cancer of the stomach forms nearly one-third of all the cancers of the human body. So far as I know this is not true of the lower animals, nor of uncivilized man. Trustworthy evidence on this point is for obvious reasons difficult to obtain. Why is there this extraordinary frequency of cancer of the stomach? Is the stomach a trap and the cancer parasite, if it be a parasite, strained out in the stomach? If that were true, why should not cancer of the stomach be as frequent in the lower animals as in man? In rats, cancer of the stomach is exceedingly common when the animals feed on cockroaches infested with nematodes, which cause a chronic irritation of the rat's gastric mucosa¹⁷. Under other conditions it is very rare in these animals.

Whenever cancer is found with great frequency in certain situations or in only one class of individuals, it appears to depend on a single cause, this is probably true of gastric cancer. Is it not possible, therefore, that there is something in the habits of civilized man, in the cooking or other preparation of his food, which acts to produce the precancerous lesion? And it is probable that there is just one cause since, if there were many causes, gastric cancer in man would have no such preponderance. Numerous factors would cause the development of cancer in other races and species equally exposed to their action. If we could but know what peculiar agency was responsible for the extraordinary frequency of cancer of the stomach, the knowledge would play a great part in the prophylaxis of cancer.

Has the question of the acidity of the stomach anything to do with the problem? The frequency of cancer in the stomach and in the large intestine, where the secretions are acid, and the absence of cancer in the small intestine, where the secretions are alkaline, is a remarkable fact. Yet this acidity of the stomach is not confined to man, but, so far as I know, the extraordinary frequency of cancer of the stomach is confined to man and to civilized man. Further investigation is needed to elucidate this most interesting problem and a possible source of infor-